SCIENTIFIC AMERICAN

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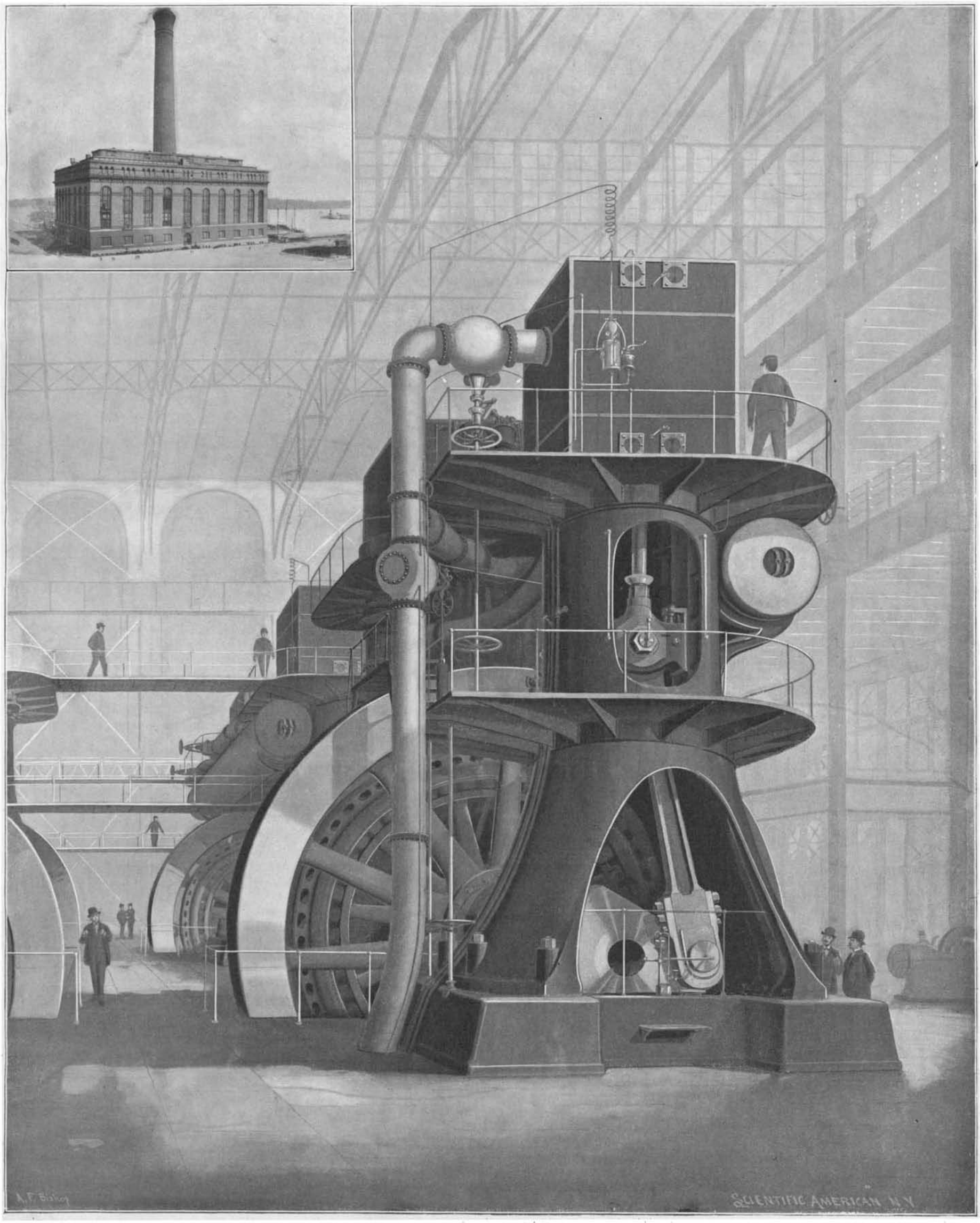
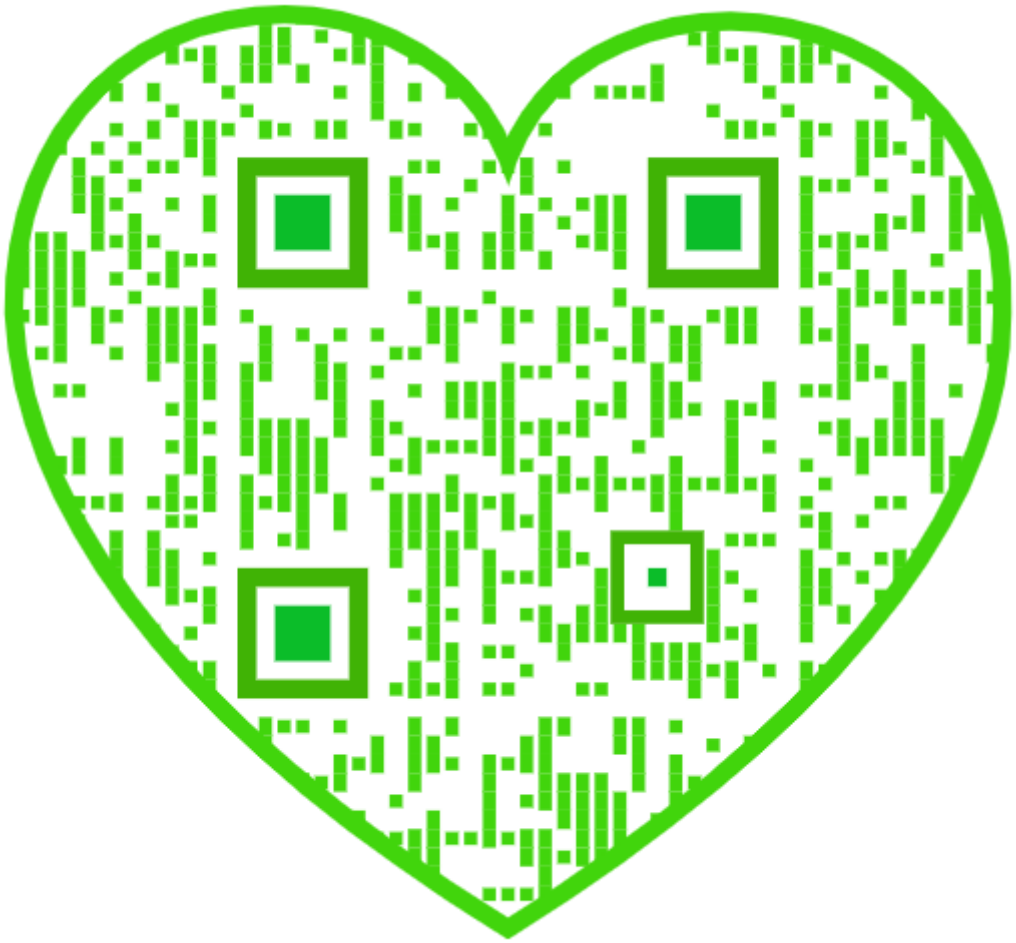


THE 70,000 HORSE POWER STATION OF THE METROPOLITAN STREET RAILWAY COMPANY, NEW YORK.—[See page 26.]



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NEW YORK, SATURDAY, JANUARY 13, 1900.

ARMORED TRAINS.

It is probable that the Franco-Prussian war was the first campaign in which protected trains and locomotives were used on the field of battle. In the various sorties from Paris the French troops were frequently assisted by the fire of light field pieces carried on cars, and when the communists were holding the capital against the troops at Versailles an armed train operated upon the railway in the direction of Château Breçon and is said to have achieved its object in silencing the batteries which the regulars were endeavoring to establish in that position. This experience perhaps gave rise to the belief that the French were the originators of the utilization of permanent lines of railway for the transport of artillery capable of being brought into action while upon the rails themselves. Captain Fisher's armorclad train was used during the first stages of the campaign against Arabi. It was built at Alexandria by a party of bluejackets, and was composed of a locomotive and a number of trucks protected by iron rails, iron plates and sandbags. The engine was placed in the middle of the train, while a Nordenfelt machine gun was mounted on the leading protected truck and a 40-pounder on the next. The latter could by means of a small crane carried with the train be quickly mounted and dismounted, one minute sufficing from the halting of the train to remount and fire the gun. Two empty trucks were run in front to explode any mines which might have been laid. The cars behind the engine conveyed a detachment of skirmishers.

There was not an opportunity for any great use of this train, although on one occasion it did do admirable work. Since that time France and Germany have recognized specially constructed armor trains as formidable units of fighting equipment, but none are as complete as that possessed by the First Sussex Artillery Volunteers of England, which has perhaps the most complete train of its kind in the world. The truck was specially constructed for the gun which is mounted on an ordinary field carriage and consists of a turntable pivoted on the center so that it can be turned in any direction. The gun detachment is protected by a plating 6 feet high around three of the sides. The gun is fired through an opening, and the recoil is checked by a hydraulic brake on its own carriage. By an ingenious arrangement of cross girders it can be run out and supported on blocks, and a broad base may be obtained for the truck when the gun is fired at right angles to the rails. To insure stability the truck can be secured to the rails by strong screw clips. The remainder of the train is made up of an ordinary locomotive and two steel-plated vans conveying a Maxim gun, the men, horses and the projectiles.

Armored trains mounting field pieces and machine guns are being extensively employed by the American troops in the Philippines, and the successful issue of the fight at Calumpit was attributed to the opportune arrival of such a flying battery. The main objections to the practicability of the armored train is noted in The London Daily News. It is suggested that the enemy, with a few men carrying small quantities of dynamite, could easily destroy the roadbed. They could undoubtedly do this if the defender's cavalry remained idle, but armored trains should always be accompanied by a strong force of cavalry. In the hastily constructed British and Boer armored trains, machine guns or very light field pieces are given as armaments. Trucks carrying such guns and soldiers should, of course, be protected by bullet-proof mantlets, but it was a mistake to make them very thick, with the idea of keeping out shells.

THE NEW CENTURY.

Although it has not yet arrived, this long-awaited twentieth century, many of those who may never live to see it are vexing themselves with the question: When will it begin? In the daily and weekly press we find a fierce epistolary battle raging between those who believe that the year 1899 marks the close of the nineteenth century and those who hold that not until 1901 shall we cross the threshold that divides us from a new era. Our own mail brings us many an inquiry from anxious readers who have not yet decided whether they be living in the nineteenth or twentieth century.

Trivial as these disputes may appear, they are not without a certain value. Without sharply defined divisions of time we could hardly grasp the world's history or place the leading events in our own lives.

It seems so difficult to understand that 1800, 1900, 2000, designate not the beginning, but the end of a century, that one naturally inquires the origin of the error. It may be that the mistake is due to a kind of optical illusion. The year 1900 marks the beginning of a new series of numbers; and nothing seems more natural than that it should therefore be considered as the first year of a new cycle. But though our reason may tell us that the new number with its two ciphers stands for the end and not for the beginning of a century, our eyes still betray us. It is a triumph of sense over intellect—an error, surely, but one into which many famous men have fallen.

When in 800 A. D. Charlemagne introduced the calendar which commences with the birth of Christ, he too thought he was beginning a new century. When Peter the Great decreed that our chronology should be used in his dominions after the year 1700, he made a similar mistake. Throughout the world's history those two ciphers have deceived men. And the error has been handed down to our own day. The Paris Exposition will be inaugurated, surely not to celebrate the death, but the birth of a century; and still it will be held in 1900. The Emperor William has decided *ex cathedra* that the new century begins January 1, 1900, but this delusion is hereditary, as he shares it with his grandfather, the late Prince Consort, who was of the same opinion. Lord Kelvin, great mathematician and physicist as he is, also holds the same view. The Roman Church, which has always paid great attention to the calendar, and has done much to preserve it, has decided that the year 1900 should be a year of jubilee as being the last of the century.

The problem is not so easily solved as may be imagined. It is evident that there never was a year 0, that the century must begin with a 1; it is equally evident that even as a dollar contains 100 cents, so a century is composed of 100 years. But then there arises the confusion of numbers and their values, the contradiction between ordinal and cardinal. When an Italian speaks of his *cinquecento* (*mille cinquecento* in other words), he refers not to the fifteenth but to the sixteenth century; and thus he writes all his centuries with a cardinal number one less in value than the ordinal number in his mind.

When we write 1899, the number 18 designates not the eighteenth, but the nineteenth century; and we are constantly compelled to correct a seeming error in our chronology. It is here that our eyes deceive us. So accustomed are we to the intentional misreading of our centuries, that we naturally consider the first two numbers in 1900 to stand for the twentieth century.

A hundred years ago the same wordy war was waged; a hundred years hence it will be renewed; and thus it will go on as century after century comes rolling along. It is a venerable error, long-lived and perhaps immortal.

THE ELECTRIC FISH OF THE NILE.

In a recent lecture before the Royal Institution of Great Britain, Mr. Francis Gotch gave a most interesting lecture on the formidable fish found in the rivers of northern and western Africa (Malapterurus electricus), of which Science publishes an abstract. Photographs were shown of the drawings upon the interior of the tomb of Ti, showing that the fish was recognized as remarkable by the Egyptians 5,000 years before the Christian era. Living specimens of the fish were also displayed, and the structure of the electric organ was then described. It is situated in the skin, inclosing the whole body of the fish, and has a beautiful and characteristic appearance when seen in microscopic sections. Each organ consists of rows of compartments and each compartment has slung athwart it a peculiar protoplasmic disk shaped like a pelate leaf with a projecting stalk on its caudal side. Nerves enter each compartment and end in the stalk of each disk. By these nerves the impulses can reach the organ. The arrival of such impulses at the nerve terminations evokes a state of activity which is associated with the development of the electromotive charges of considerable intensity. The shock is intense, the current traversing the whole organ from head to tail and returning through the surroundings. It stuns small fish in the neighborhood, and can be felt by man, when the hand is placed near the fish, as a smart shock reaching up the arm to the shoulder.

Recent investigations carried on at Oxford by the lecturer were then described. A series of photographic records of the displacement of the mercury of a capillary electrometer in consequence of the electrical disturbance in the organ was shown. These records exhibited the time relations, mode of commencement and manner of subsidence of the shock, and demonstrated its similarity to the electrical changes known to exist in nervous tissue during the passage of a nervous impulse. Each effect consists of a rhythmical series of electrical changes occurring one after another in a perfectly regular manner at intervals of 1-100 to 1-300 of a second, the rate depending upon the temperature. The potency of the organ as a weapon to be wielded by the fish is thus enormously increased by its resemblance to a self-loading and self-discharging automatic gun. The total electromotive force of the whole organ in a fish only 8 inches long can reach the surprising maximum of 200 volts, at any rate in the case of an initial shock. The attainment of this maximum is due to the simultaneous development of perfectly similar electromotive changes in each of the 2,000,000 disks of which the organ is composed.

The remarkable character of the nervous connection of the organ was then described. Each lateral half of the organ, although it has a million plates receiving nerve branches, is innervated by one single nerve fiber, and this is the offshoot of a single giant nerve cell situated at the cephalic end of the spinal cord. As regards the nervous impulse which the fish can discharge through this nerve cell, experimental results show that the fish is incapable of sending a second nervous impulse after a preceding one until a period of one-tenth of a second has elapsed, and this interval is rapidly lengthened by fatigue to as much as several seconds. The inability of the central nervous system to repeat the activity of the organ obviously presents disadvantages to the use of the shock as a weapon for attack or defense, but such disadvantage is more than counterbalanced by the property of the organ alluded to, of self-excitation; since a whole series of shocks continue to occur automatically in rapid succession, provided that an initial one has been started by the arrival of a nervous impulse sent out from the central nerve cell.

UNEARTHING FOSSIL REMAINS.

A photograph was recently sent to this office of some interesting fossil recently discovered in Nest County, Kansas. The specimen is of very unusual form, and was claimed by the owner to be a fossilized gall sac or bladder. It was found quite near the remains of a Tylosaurus mosasaur, photograph of which was also taken. The photograph was submitted by the editor to the Museum of Natural History for an opinion in regard to the identity of the object. Prof. Henry Fairfield Osborn, in his reply to the editor, called attention to a fact which it is well to bear in mind. He says, after examining the photograph: "The mosasaur is so badly injured that it is of no value to any one. I am glad to see that you are giving so much attention to these general scientific matters. I hope you will disseminate the view as widely as possible that the first thing to do after discovering a fossil is not to dig it out, but to leave it alone and to write to some representative museum, either the American Museum of Natural History or the United States National Museum, reporting the discovery and asking for instructions. In this way the commercial value of the specimen will be very much enhanced." It is a well known fact that the unearthing of fossil remains requires the greatest care and calls for knowledge on the part of the operator. We are only too happy to call attention to Prof. Osborn's timely advice, especially at this time, when the discoveries of fossil remains are becoming more frequent, and a knowledge of the work that has been carried on in the West by the many scientific expeditions which have been sent there during the past few years is being more fully understood and appreciated.

CONGRESS OF PHOTOGRAPHY IN 1900.

Preparations are now being made for an international congress of photography, to be held in Paris next year. A committee has been appointed for the purpose, under the presidency of M. Janssen. This committee is sub-divided into five sub-commissions, which will have charge of the five sections and will prepare the programme of the work to be carried out in the sessions of the congress. These five sections are constituted as follows: 1. Physical questions relating to photography. 2. Photographic materials. 3. Photographic chemistry. 4. Terminology and bibliography. 5. Legal and professional questions. All applications for admission to the congress, for which the fee is fixed at 10 francs, as well as all other communications, should be addressed to the general secretary, M. S. Pector, 9 rue Lincoln, Paris. Among the members of the committee may be mentioned Messrs. Vidal, Lippmann, Braun, Lumière and Molteni.

GERMAN explorers have been engaged for some time in excavations on the site of the palace of Nebuchadnezzar. According to The Architect, there was discovered in August a column which bore a representation of the Hittite god. The figure corresponds with one found in Sandskirli, which is now in the Berlin Museum. It is supposed that both works were taken as part of the booty in some ancient expedition.

THE GEOLOGICAL SOCIETY OF AMERICA.

The twelfth annual meeting of this society was held in Washington, D. C., beginning on Wednesday, December 27, the large hall in Columbian University being the meeting place. The society was welcomed to Washington by Dr. Grove K. Gilbert, of the United States Geological Survey, and an apt response was made by the president of the society, Prof. Benjamin K. Emerson, of Amherst College.

The secretary reported that there were 230 names upon the membership list, with eight candidates awaiting election. He also reported the society to be in excellent financial condition. The librarian reported that 160 volumes had been bound during the year, and hoped during the ensuing year to complete all the binding that was in arrears.

The necrology included the reading of the following notices: Memorial of Othaniel C. Marsh, by Prof. Charles E. Beecher; Memorial of Oliver Marcy, by Prof. Alja R. Crook; Memorial of Edward Orton, by Dr. Grove K. Gilbert; and Memorial of Sir J. William Dawson, by Prof. Frank D. Adams.

The society then took up the reading of papers; the first of these was "Physiographic Development of the Washington Region," by Nelson H. Darton, of the United States Geological Survey. Prof. William M. Davis, of Cambridge, Mass., followed with a paper on "Physiographic Terminology with Special Reference to Land Forms." The third paper was one by Dr. Edmund O. Hovey, of the American Museum of Natural History, New York city, on "Erosion Forms in the Harney Peak District, Black Hills, South Dakota." He described those peculiar forms that are found in the schists and pegmatites in the Harney Peak district, where he spent a portion of last summer. The paper was illustrated by lantern views. Messrs. George O. Smith and George C. Curtis, of Washington, D. C., and Boston, Mass., presented a joint paper entitled "Camas Land, a Valley Remnant." It was a description of the old valley on the eastern slope of the Cascade Mountains in Washington. A relief model of Camas Land was exhibited. This interesting valley owes its preservation above the circumdenudation to an intrusive sheet of diabase. Two papers by Mr. W. S. Tight, of Granville, Ohio, followed, the first of which was entitled "Topographic Features of Ohio," and was a description of the different sections of the State, with an attempt to show the reasons for the different types. It was fully illustrated with lantern views. His second paper was entitled "Drainage Modifications in Southeastern Ohio," and described the extensive changes in drainage of the region north of the Ohio River and between the lower Muskingum and the lower Scioto. The lower Muskingum, south of Zanesville, was shown to be a composite stream made up of sections of four preglacial streams which crossed the course of the present Muskingum. These four streams, he showed, were united in what is now the Little Hocking basin, and the main line of preglacial drainage extended formerly across the present Hocking River, which was also shown to be composed of sections of several preglacial streams running into the basin of Raccoon Creek and across this basin into the Scioto River below Chillicothe. He also described several of the tributaries of this preglacial river.

Prof. Israel C. Russell, of the University of Michigan, spoke on "Deposits of Calcareous Marl in Michigan." He said that a large number of lakes and swamps in the southern peninsula of Michigan had been found to contain deposits of calcareous marl suitable for the manufacture of Portland cement. This marl he described as being composed in part of shells, but mainly consisting of a chemical precipitate which is still being deposited. The better grades have been found to contain from 80 to 95 per cent of calcium carbonate. The supply of these marls has been found to be practically inexhaustible, and in consequence several large cement works have already been established and others are in contemplation. He predicted that Michigan would be likely to take a leading place in the near future in the Portland cement industry. Dr. Grove K. Gilbert, of the United States Geological Survey, presented a paper on a "Submerged Forest of the Columbia River." He said that the cascades in the Columbia River flow over a natural dam of rock fragments. This dam had been made by a landslide that came from the north not less than 350 years ago, and in the pond were sound stumps of Douglas spruce. He discussed the various explanations that have been proposed, and said that he believed that those presented by Newberry best accorded with the facts. A second paper by Prof. W. M. Davis, entitled "A Recent Fault Scarp in the Lepini Mountains, Italy," was next read. The Lepini Mountain group is a sub-maturely dissected block of Cretaceous strata, forty miles southeast of Rome. A recent movement on the line of a tertiary fault has produced a well-defined scarp in places 100 to 200 feet in height and traceable five miles or more along their northeastern base. This was described somewhat elaborately by Prof. Davis. Mr. Bailey Willis, of the United States Geological Survey, under the title of "Some Coast Migrations, Southern California," described the formations constituting the Santa Lucia Range of the Coast Ranges and their relations to each other, and indicated the presumable corresponding migrations of the Pacific Coast. The section of coast described extends from Point Sur to Piedras Blancas between Monterey and San Luis Obispo.

On the conclusion of the reading of this paper the society adjourned until the evening, when a special session was held to listen to the presidential address of Prof. Benjamin K. Emerson, of Amherst College, who spoke on the "Tetrahedral Earth and the Zone of the Inter-Continental Seas." This paper, which was illustrated with lantern views, was a very full discussion of the theory advanced by Greene, who has contended that the earth in cooling would be likely to assume the form of a tetrahedron. This novel proposition has, during recent years, created considerable interest and has been widely discussed by many prominent geologists, including the veteran Suess, of Vienna. Prof. Emerson described the various views of the author, as well as those who have discussed his paper, and illustrated with diagrams the various forms that the earth would be likely to assume in its change of form.

Prof. Herman L. Fairchild, of Rochester, N. Y., who is also secretary of the society, presented an exhibition, by lantern slides, of "Beach Structures in Medina Sandstone," the structure of which indicated shallow water and beach deposits. Mr. Harry F. Reid, of Baltimore, presented two papers on glaciers; the first, entitled "Movement of Glaciers," gave the results of several years' observations of the movement of the Forno glacier, with special reference to the vertical component of the movement. He discussed at length in this connection the existence of surfaces of finite shear in glaciers. His second paper was on the "Stratification and Banded Structures of Glaciers." Mr. Reid has been engaged for some time in examining a number of the glaciers in Switzerland, and he has followed the outcrops of the strata from the névé-line practically to the end of the glacier, and his investigation convinced him that the banded structure is the modified appearance of the outcrops. This he discussed somewhat in detail, and further explained why certain glacialists have held divergent views on the subject.

Prof. J. B. Woodworth, of Cambridge, Mass., followed with a paper on the "Glacial Origin of the Older Pleistocene in the Gay Head Cliffs, with a Note on the Fossil Horse of that Section." He described the occurrence of glacial fragments in the bowlder bed at the base of the older Pleistocene (Columbia) in the Gay Head section, which confirmed, he thought, the theory of the existence of an ice invasion long antedating the surface moraines of the New England islands. This paper was especially interesting on account of the description of the astragalus of a mammal which he found in the Miocene underlying the bowlder bed at Gay Head. This was identified by Prof. H. F. Osborn as belonging to a horse.

A second paper by Prof. Fairchild was on "A Channeled Drumlin," and consisted of a description of a longitudinal hollow (channel ?) in a drumlin terminating at the lower end by a transverse cut, which he illustrated by lantern views.

The next paper was by Mr. A. P. Coleman, of Toronto, Canada, and was on a "Distinction Between Upper and Lower Huronian." He described the finding of a band of rock consisting of fine-grained sandstone, chert, or jasper with interbedded iron ore at Michipicoton, on the northeast shore of Lake Superior, which corresponds to the Vermilion and other iron-bearing series west and south of Lake Superior. This band has been traced for 30 or 40 miles, and has been recognized at various points to the west, as far as Rainy Lake, and east to Lake Temagami. Many fragments of this rock were found in the Upper Huronian at Gros Cap and other points as far west as Shoal Lake and east to Lake Temiscaming, a distance of more than 600 miles. It is the most easily determined member of the Lower Huronian, and is of great value as showing the connection between the two parts of the series. It represents a great lapse of time, as is proved by the Shoal Lake conglomerate. Mr. Charles Schuchert, of the United States National Museum, presented a paper on the "Lower Devonic Aspect of the Lower Helderberg and Oriskany Formations." He discussed the Silurian of Murchison and the American equivalents; then passing to the Devonian of Sedgwick and Murchison he pointed out that it has no marked Lower Devonic fauna. He then described the Lower Devonic of Germany, and finally pointed out that the Helderberg fauna was transitional to the Oriskany, and that these constituted the American Lower Devonic. "The Silurian-Devonian Boundary in North America" was the title over which Prof. Henry S. Williams, of Yale University, presented a discussion of the principles to be used in determining the boundary between the two systems—Silurian and Devonian—standard sections of which are on another continent, and then discussed the facts of correlation as bearing on the case. The final paper presented on the second day was on the "Devonian Strata in Colorado," by Arthur C. Spencer, of Washington, D. C. In 1874, the presence of Devonian rocks in southwestern Colorado was asserted by the late Dr. F. M. Endlich, and this has recently been confirmed by the observations of a party of the United States Geological Survey under the direction of Dr. Whitman Cross. These observations were described by the author. He said the section when complete is three-fold, consisting of a conglomerate and sandstone at the base, followed by a calcareous shale, and this by a massive limestone containing considerable numbers of invertebrate fossils. The limestone is shown by its outcrops to have covered an area of at least 600 square miles. The sandstone and shale beds are locally absent through non-deposition. Their age is possibly Silurian, though they contain occasional fish remains, which would ordinarily be considered indicative of the Devonian. The silicious series is correlated with the "Parting Quartzite" of central Colorado, and mention was made of further probable equivalency between this series and the supposed Devonian of the Grand Rapids region. This brings out the probability that these formations of the Middle Paleozoic were originally deposited over a very extensive area in the southern Rocky Mountain region.

On December 29, after discussing business matters regarding the appointment of delegates to the Paris Exposition, the society proceeded to the presentation of the following papers:

The first of these was on the "Newark Formation of the Pomperaug Valley, Connecticut," by William H. Hobbs, of Madison, Wis. This paper, which was somewhat lengthy, was of special value from the fact that it gave support to the broad terrane hypothesis regarding the extent of the Newark formation. It showed that an irregular block of the Newark had been depressed below the level of the crystalline gneisses, so as to be protected from the abrasion of the ice of the glacial period. Dr. David White, of the United States Geological Survey, read a paper on the "Relative Ages of the Kanawha and Alleghany Series as Indicated by the Fossil Plants." He said that from an examination of the stratigraphic distribution of the fossil plants of the Kanawha series in southern West Virginia, it appeared that only the upper half of the series contained the common and characteristic elements of the floras of the Alleghany series of northwestern Pennsylvania. The lower half carried a flora which he found distinctly older than any of the floras which occurred above the lowest coal of the Alleghany series. He also presented a brief statement of the stratigraphic changes and conditions of deposition in the Virginian region, as indicated by the distribution of the fossil plants. Mr. Marius R. Campbell, of the United States Geological Survey, under the title of "Stratigraphy of the Pottsville Series in Kentucky," discussed the areal distribution of the conglomerates in the Pottsville series along the western margin of the Appalachian coal field in Kentucky and Tennessee. Three distinct horizons of conglomerates are described which heretofore have been regarded as a single stratum. Attention was called to the unconformity at the base of the series, and the vertical expansion southward was illustrated by numerous sections measured along the margin of the field. The "Jurassic Rocks of S. E. Wyoming" were discussed by Mr. Wilbur C. Knight, of Laramie, Wyoming. He reviewed the early history of the Jurassic investigations in Wyoming, and gave the distribution of both the marine and fresh water beds in that portion lying east of the North Platte River and south of the Fremont and Elkhorn Railroad. He discussed geological sections from several localities, and made reference to the fossil remains found in them. He concluded with some remarks on the grouping of the Rocky Mountain Jurassic beds, showing their correlation with European formations. "The River System of Connecticut" was the title of a second paper presented by Mr. William H. Hobbs, of Madison, Wis., and he showed a carefully prepared map based upon the recent topographical map of Connecticut by the United States Geological Survey, on which it appeared that all the master streams flowed into troughs, which corresponded closely in direction with the fault directions of the Pomperaug Valley system and with two additional closely related directions. From these facts he inferred that the entire area of the State of Connecticut had been deformed by faulting in pretty much the same manner as had been the case in the Pomperaug Valley. Mr. Nelson H. Darton, of the United States Geological Survey, discussed "Mesozoic Stratigraphy of the Black Hills of South Dakota." Another paper of his was on "Tertiary Shore Lines and Deposits in the Black Hills."

The annual election of officers, which took place during the session, resulted as follows:

President, George M. Dawson, Ottawa, Ont.; first vice-president, Charles D. Walcott, Washington, D. C.; second vice-president, N. H. Winchell, Minneapolis, Minn.; secretary, Herman L. Fairchild, Rochester, N. Y.; treasurer, Israel C. White, Morgantown, W. Va.; editor, J. Stanley Brown, Washington, D. C.; librarian, H. P. Cushing, Cleveland, Ohio; and councilors, William B. Clark, Baltimore, Md., and A. C. Lawson, Berkeley, Cal.

POWERFUL ELECTRIC PUMP AT AUSTIN, TEXAS.

BY CHESTER HAILE.

Several years ago the city of Austin, Texas, at an expense of two million dollars, constructed the largest artificial dam in America. The site was upon the Colorado River, a stream of abundant supply, and of reasonably pure water, but at times, owing to heavy rains and other natural causes, the flow would become exceedingly muddy, and a continuation of such conditions threatened at times to endanger the general health.

With these confronting conditions, General Superintendent H. C. Patterson began a series of investigations, basing his operations upon the fact that a too common error is often made in taking water from neighboring rivers, which at the time may be of good quality, but afterward, owing to rapidly increasing population, become polluted and dangerous for drinking purposes, and sought to avoid such conditions in the manner hereinafter set forth. In his compilation of statistics bearing upon this subject, he submitted to the proper authorities the result of his investigation, and among many other interesting items has the following to say relative to typhoid fever as produced by impure drinking water.

TYPHOID FEVER.

(Taken from Mr. Patterson's report.)

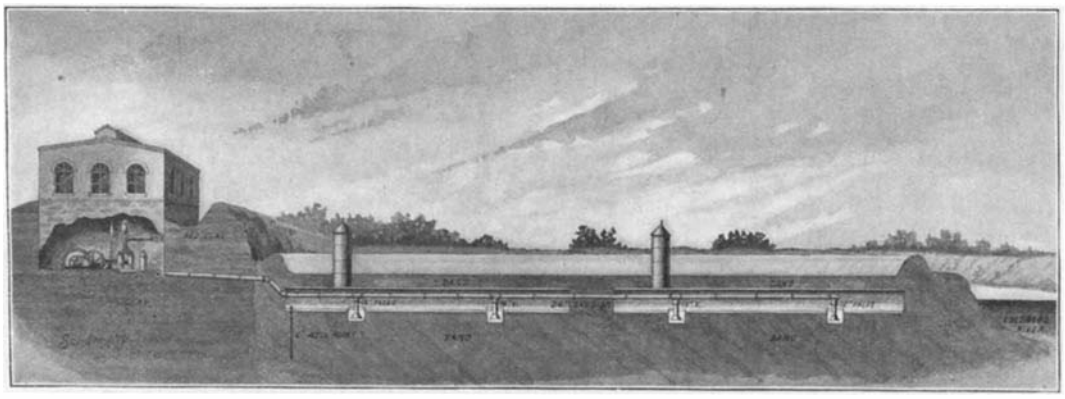
Typhoid fever death rate per 100,000 population, taken from American cities, on an average of seven years was 42 cases, where water was taken from lakes.

An average of five American cities over a period of seven years, taking their water from rivers, 58 cases.

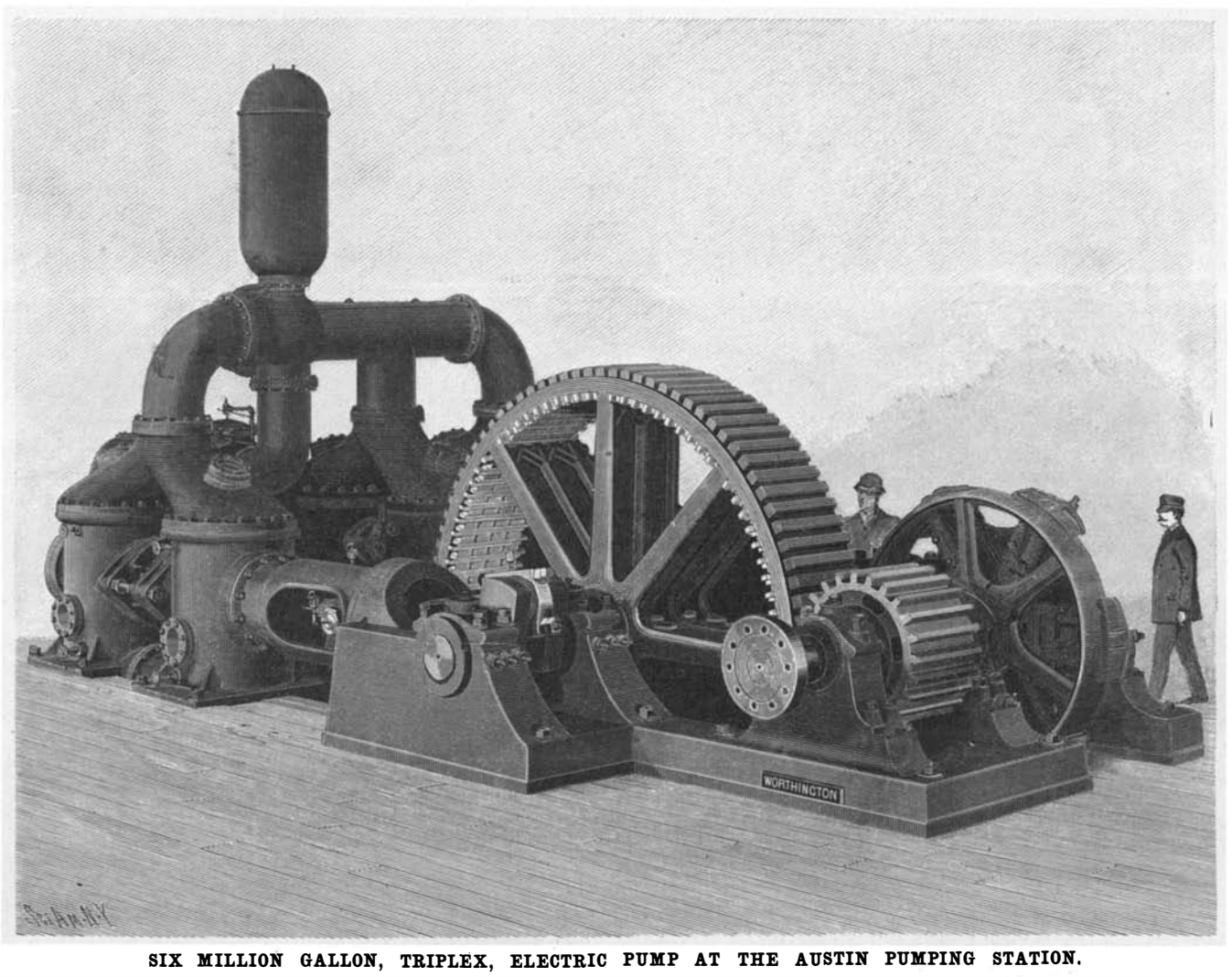
Average of six European cities, over a period of seven years, using filtered water, 12 cases.

The above comparisons apply more to the city of Chicago than probably any other city in the United States. Chicago uses lake water exclusively, and according to all statistics, has had as many as 154 cases of typhoid fever to the 100,000 population; while Munich, whose water is submitted to the filtration process, has had as low as three cases of typhoid fever per 100,000 population.

The true manner, Mr. Patterson contended, to secure a lasting supply of pure water was by the filtration process, either natural or artificial. Acting upon his suggestions, the city decided to build another pumping plant in addition to the one already in use at the dam, two and a half miles nearer the city, and on a large deposit of filtering sand beside the river. About two years ago this station was completed, its dimensions being 50 by 50 feet, and the pumping pit was so situated that the pumps would never lift water over fifteen feet. The water for this station was taken from filtering trenches by large, reciprocating, power pumps, driven by electric motors, power being transmitted from the main power plant.



SECTION THROUGH PUMPING STATION AND FILTERING TRENCH.



SIX MILLION GALLON, TRIPLEX, ELECTRIC PUMP AT THE AUSTIN PUMPING STATION.

THE FILTERING TRENCHES (FIG. 1).

The filtering trenches built in this sand bed, as mentioned above, are 10 feet wide and 180 feet long, three in number, and joined together by 20-inch tile pipe. These trenches are below the low water condition of the river, and as they are pumped the difference in level causes a supply of water to pass into them. Each trench also has eighty 2-inch well points driven to a depth of 25 feet. The three trenches are connected with the pumping station by 600 feet of 24-inch cast iron suction pipe. The first pump installed was a four million gallon Worthington duplex pump, with plungers 19½ inches in diameter and 24-inch stroke, making 26 revolutions per minute.

This pump is driven by a synchronous motor built by the General Electric Company, running 600 revolutions per minute. It has been in operation for about one year, and much experience was gained in the installation of this set, to assist the superintendent in the design of another pump. It was found after a careful examination that eighty-six per cent of the energy delivered to the motor came out in the shape of water to the general system.

The experience gained in the installation of the first pump pointed strongly toward a triplex pump and a slower running motor; and after several months of careful study and deliberate calculations, in November of last year a second pump, of the triplex pattern, six million gallons capacity, designed to run twenty-five revolutions per minute, was designed by Superintendent Patterson, and drawings of same made by Civil Engineer Charles R. Watts, and an order was placed with Henry R. Worthington.

This powerful pump has lately been completed, and delivered by its makers to the city of Austin, at a cost of $29,000. It is run by a 300 K. W. synchronous motor making 100 revolutions per minute. The advantages of the triplex pump are that it will maintain a more constant pressure on the mains, and be much easier on the motor. The pump is an outside packed plunger pump, 18½ inches in diameter, by 24-inch stroke, and the two pumps together will deliver 10,000,000 gallons of water per day into the mains.

A great deal can be said in favor of synchronous motors for work of this character, they being very efficient, giving absolute constant speed under all conditions, and standing an immense amount of abuse, their only failing being lack of starting effect, and this has been provided for by getting the motor up to speed, and starting the pump by a very large friction clutch. When once energized they can be overloaded to the extent of three hundred per cent before dropping out.

In the construction of this new filtering plant, Austin will secure 10,000,000 gallons of filtered water, which cannot be polluted and become dangerous for drinking purposes; a danger which exists as we have shown in water drawn direct from the rivers.

Action of Nitrogen Dioxide on Chromium.

M. G. Chesneau has presented to the Academie des Sciences a description of his recent experiments showing the action of nitrogen dioxide gas upon solutions of the salts of chromium. The previous experiments in this direction have shown that the gas is absorbed by ferrous and by chromous salts, but in the latter case it has been hitherto impossible to carry on the experiments properly, as the solutions decompose rapidly in contact with air. The experimenter has found a simple expedient to exclude the air, and has thus been able to study the reaction of the gas upon the chromous salts. These are produced in the first place by the reduction of a hot solution of a chromic salt, acid or neutral, by pure zinc. The liquid is preserved from the action of the air by a layer of heavy petroleum, sp. gr. 0·870; this layer, from 5 to 10 centimeters thick, is sufficient to keep the solution from decomposing for several weeks. To transfer a portion of it to another vessel, it is taken out by a pipette having a fine point; a certain quantity of oil is introduced first, which keeps the solution always covered. This method of protection may be used to advantage in working with ferrous salts or others easily attacked by air. A number of experiments have thus been made with the chromous salts; with a soda solution, for instance, a hydrate was obtained, of a fine turquoise blue.

The absorption of nitrogen dioxide by the salts has been successfully carried out. It may be remarked that the solutions formed as above contain zinc, but this has no appreciable effect upon the reaction. The gas is first purified and dried, then passed through a neutral solution of chromous chloride contained in a small flask. In this way an absorption of 0·257 gramme of the gas is obtained for 85 centimeters of solution. As the absorption disengages a certain amount of heat, the temperature of the apparatus is regulated by a refrigerating bath to about 15° C. The solution takes a fine dark red color, which is quite different from the brown tint assumed by the ferrous salts under the same conditions. This color changes to a greenish brown at the end of an hour; the change is immediate if the temperature is raised to 100° C. While the ferrous salts give off the gas absorbed upon heating or in vacuo, the salts of chromium retain it, and a veritable combination may be considered as formed in this case. The experimenters consider that the action is one of simple absorption, as the gas after passing through the solution has not been decomposed. The red liquid gives with soda a gray precipitate soluble in excess to a violet color, without disengagement of gas; this solution becomes green after a time. A like series of results has been obtained with acid solutions of chromous chloride and sulphate.

RUNNING from Phillipsburg to Newark, N. J., there is a most remarkable canal. It is 60 miles long, and was operated before any railroads were built in the State. At times it runs side by side with the Lackawanna Railroad. Locks are not used, the boats being drawn up and down elevations on great cars on a truck 18 feet wide. This is likely to be the last year of its operation, as an effort will be made at the next session of the New Jersey legislature to secure it as a means of furnishing Jersey City with an additional water supply.

OIL ENGINE WITH DIRECT-CONNECTED GENERATOR.

For many years Europe was ahead of this country in its use of gas and oil engines, while we led the world in the development of electricity and the construction and use of electric machinery. To-day, however, there is a growing appreciation of the economic merits and wide range of application of the former types of motive power, and the firms which were early in the field in the design and construction of gas and oil engines have their hands full in keeping pace with the demand. The merits of the gas engine are well understood, and the same advantages of low first cost, ease of application and handling, and cleanliness, render the oil engine an ideal prime mover where small units of power are required, while the cost of operation is greatly reduced.

We herewith illustrate a Mietz & Weiss engine which consumes the ordinary kerosene of commerce. These engines are made in eight sizes ranging from 1 up to 20 horse power. The 1 horse power engine weighs 600 pounds and covers 30×36 inches of floor space, while the 20 horse power engine calls for 60×90 inches and weighs 6,500 pounds. The engine illustrated is of 4 horse power and is direct connected to a generator which is mounted upon a common base, and has a capacity of forty 16 candle-power incandescent lamps. As the engine is of the two-cycle type, with an explosion at each revolution, it is susceptible of a more perfect regulation than the four-cycle engine. The crank shaft is entirely inclosed, with a view to excluding dust and dirt, and particular attention is paid to lubrication, a special oil reservoir being provided at the right side of the engine frame, from which the oil is drawn by the partial vacuum formed, during each revolution, in both crank chamber and cylinder, and fed to the crank pin and cylinder, the main bearings being taken care of by automatic ring oilers. The kerosene, which is carried in a closed copper tank firmly screwed to to the cylinder, has a capacity of ten hours' run. The consumption is about three-quarters of a pint per horse power hour.

The oil is fed from the tank to the cylinder by a small oil pump, operated by an eccentric on the main shaft, an injection of oil taking place at each revolution. The place of the throttle in a gas engine is taken by a little hinged finger on the plunger of the oil pump. When it is desired to stop the engine, the latch is thrown up, clear of the follower, and the pump is thereby thrown out of operation. The amount of oil fed to the cylinder is controlled by a simple and effective governor.

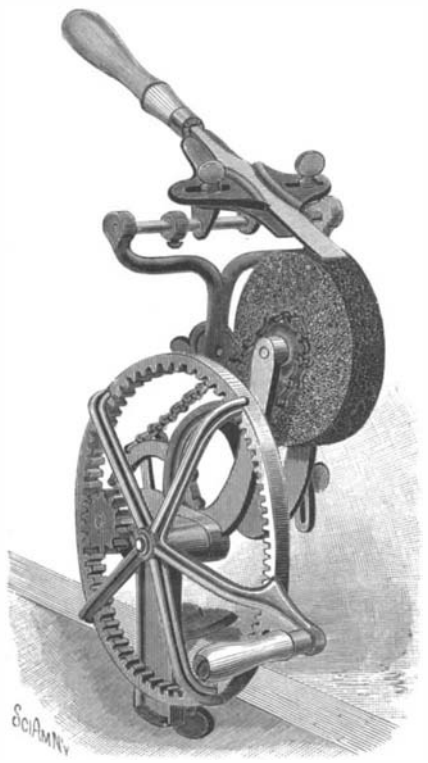
The direct connecting of a generator to an oil engine calls for a certain measure of elasticity in the coupling, although, as already explained, the fact that an impulse is given at each revolution secures a very even running in these engines. In the coupling the power is transmitted through three studs provided with rubber rings which are of sufficient strength to carry more than the required load, and serve to absorb all shock and ease the strains due to sudden variations of load, or to the irregularity in the alinement of the engine and dynamo. The engines are built by August Mietz, 128-132 Mott St., New York city.

The Extermination of Gulls.

The feather hunters are rapidly exterminating the small herring gulls at the east end of Long Island Sound and the islands beyond. The herring gull used to be very common in that region, but the feather hunters have killed or driven away most of them. When Agassiz had his summer school on Penikese Island there used to be a large colony of these birds, but afterward the feather hunters began their work, and according to The Evening Post, a woman who visited the island last summer saw hundreds of dead birds with their wings torn away and many wingless birds still alive fed by their mates. The larger gulls are not killed by the feather hunters as their wings are too large to be worn on hats. It is to be hoped that such cruel bird hunters, if caught, will be severely punished.

AN INGENIOUS TOOL-GRINDING MACHINE.

A patent has been granted to Mr. Arie Van Dillenbeck, of 261 Hamilton Street, Albany, N. Y., for a tool-



DILLENBECK'S TOOL-GRINDING MACHINE.

grinding machine, the novel features of which are found in the means provided for adjusting the table so that tools of various kinds can be sharpened with any desired bevel.

The machine, as our engraving shows, is supported by a standard, the base of which is clamped to a shelf or bench. The standard has an arch at its upper end and is provided with a rearwardly-extending horizontal arm at one side and with forwardly and upwardly projecting arms at the other side. A stone is mounted in the fork formed by forwardly and upwardly projecting arms and is connected by a chain and sprocket gear with a shaft mounted in the rearwardly projecting arm at the upper end of the standard and turned by an internal pinion meshing with a driving-wheel journaled in the horizontal arm at the base of the fork. By turning the driving-wheel the stone will be rapidly rotated.

The tool-holding table slides on a rod held between the arms of a fork, the shank of which is connected by a universal joint with a bar which is pivoted to one side of the arch and which can be swung to raise or lower its outer end (and hence the table) and can be locked in adjusted position. Upon the table tool-holding clamps with under-cut bodies are mounted; these clamps can be adjusted to receive tools having short or long cutting edges, such as chisels, drawknives, and the like. In sharpening a tool, the table is moved back and forth on its rod so as to sharpen all parts of the edge uniformly, collars being provided which limit the movement of the table and prevent the tool from leaving the stone. By reason of the pivoted bar and the universal mounting of the table fork, the table can be raised or lowered to accommodate thick and thin tools, or moved to or from the stone to bring more or less edge of the tool on the grinding surface to produce a greater or lesser bevel. The machine can be driven with one hand, and the table manipulated with the other. As soon as the hand is removed from the table the weight of tool-handle will cause the table to drop back and carry the tool away from the stone.

Reinforcing Platinum Prints.

It is sometimes difficult, if one has not had considerable practice in the exposure of platinotype paper, to obtain a satisfactory result upon the first trials. It often happens that the prints which have been judged to be sufficiently exposed give only gray tones upon development. The reinforcing bath given in the following formula enables one to strengthen the tones:

SOLUTION A.

Saturated solution gallic acid	50 c. c.
Saturated solution nitrate silver	2 c. c.
Acetic acid, glacial	10 drops.
Water	50 c. c.

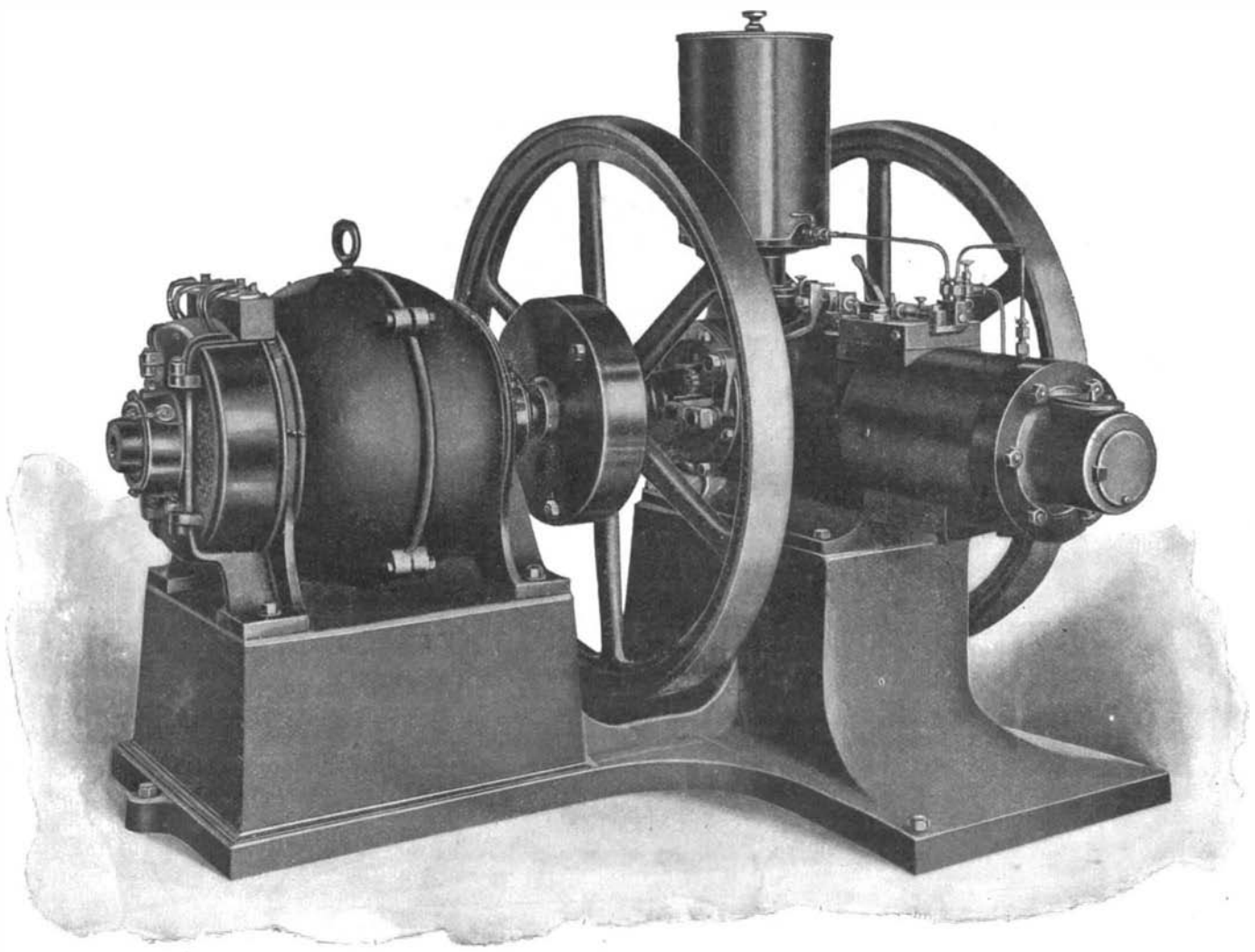
SOLUTION B.

Chloroplatinite potassium	1 gramme.
Phosphoric acid	15 c. c.
Water	600 c. c.

The prints are plunged into pure water, then into Solution A until the desired reinforcement is obtained. During this time they should be constantly agitated. They are then washed in three changes of water to which a small proportion of acetic acid has been added, and are toned in Solution B until a good black is obtained. The prints are finally washed as usual.

A Gigantic Map.

One of the most interesting exhibits which will be sent from the United States to Paris will be a huge map of New York city, which is now in progress of construction under the chief topographical engineer of the Board of Public Improvements. It measures 28 × 24 feet and is on a scale of 600 feet to the inch, and includes all the boroughs of the great city and considerable of the adjoining territory. Twelve draughtsmen are now working on the map indoors and there is a field force of eight men working outside. The map shows all the trees, parks, piers, ferries and railway lines; displays contour lines and elevations of every point in the city, and more than 1,000 square miles of the territory are embraced, and all buildings of any importance whatever are indicated. In each corner will be a pen and ink drawing 12 × 18 inches showing some notable view of the city, and around the edge are to be smaller sketches of various public buildings. A hard wood platform and bronze brackets and railings make up the mounting of the map. In connection with it there will be exhibited a copy of a relief map in the Museum at Albany showing Manhattan Island in 1776 and also two charts of the city as it looked in 1641 and 1800. The four maps will form an opportunity for the study of the city's growth during the past 300 years.



DIRECT-CONNECTED KEROSENE ENGINE AND GENERATOR.

THE Chicago drainage canal was opened on January 2, with no ceremonies.

Correspondence.

Unit of Labor?

To the Editor of the SCIENTIFIC AMERICAN:

Can any reader of the SCIENTIFIC AMERICAN state "the unit of labor"? The day's labor is not a unit. The expression means some labor, but it is indeterminate.

Similarly, the wheat from an acre of land means some wheat, but the unit of wheat, as the bushel, enables us to state the quantity.

Labor is a force. All we use is the result of labor. Our civilization is also the result of labor.

Without the unit of labor, we can have no coefficient of labor. Thus we are unable to state intelligibly the one force, or power, that produces everything.

A. BRADY.

Titusville, Fla., December 28, 1899.

True Inventor of the Telegraph.

To the Editor of the SCIENTIFIC AMERICAN:

I have just read an article in your issue of December 30 entitled "The True Inventor of the Telegraph," and purporting to have been written by Heileman Wilson.

He refers to and quotes the well-known letter of "C. M.," published in the Scots Magazine, 1753; and concludes that "it must be admitted that 'C. M.' was the inventor of the electric telegraph, and that every step made since that time, however wise and valuable, can be viewed in no other light than an improvement on the idea of an unknown man."

I dissent wholly from Mr. Wilson's conclusion. It does not appear that C. M. ever tried an apparatus or even made an apparatus embodying the ideas of his descriptions; and he consequently could not know how it would work, or whether it would work at all. Mr. Wilson at an earlier point in his article says: "It was reserved for a Scotchman, living at Renfrew, to suggest that messages might be sent by electricity along wires passing from one place to another." Here he uses the correct term. Unquestionably C. M. made a suggestion; but he did nothing more. It is, however, not the man who suggests that a certain thing may possibly be done, but the man who finds a way to do it, and does do it, who is the inventor.

No one as yet has invented the art of "Seeing by Electricity," but many persons have made suggestions as to how it may be done; and some have asserted that they have done it. When that art and a means for carrying it out shall have been invented, the people who have made the suggestions will of course be duly trotted out as prior inventors.

Mr. Wilson apparently relies too implicitly on his memory, which, however, should have told him that Plymouth is entirely out of the line of communication between London and Waterloo.

The Wellington anecdote is a very familiar one to me; but heretofore the delayed words have invariably referred in all versions of the anecdote I have seen to the battle of Salamanca. THOMAS D. LOCKWOOD.

Boston, Mass., December 31, 1899.

THE number of emigrants from Germany has fallen off within the last few years, and seems to be continually decreasing. In 1898 the number was but 20,960, which is the smallest since the existence of the empire. The table shows the emigration since 1881:

Year.	Number of Emigrants.
1881	220,900
1887	104,780
1891	120,090
1895	37,490
1896	33,820
1897	24,630
1898	20,960

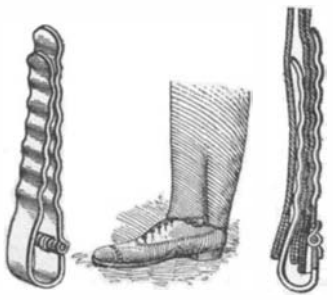
The emigrants for the year 1898 are distributed as follows: United States, 17,232; the remainder of America, 1,094; besides Brazil 785, and Canada 208. Africa received 1,092; Asia, 223; and Australia, 163. Upon comparing the figures for the emigration with that of the total German population, one finds, for 1898, 38 emigrants per hundred thousand as against 43 in 1897 and 232 in 1891. The cities of Bremen and Hamburg gave the largest proportions.

DURING the year 1898, 1,465 persons were inoculated for hydrophobia at the Institut Pasteur at Paris; of these, only 3 succumbed. This gives a mortality of 0·20 per cent. In the following table these figures may be compared with those of the preceding years:

Year.	Number Treated.	Died.	Per cent.
1886	2,671	25	0·94
1887	1,770	14	0·79
1888	1,622	9	0·55
1889	1,830	7	0·38
1890	1,540	5	0·32
1891	1,559	4	0·25
1892	1,790	4	0·22
1893	1,648	6	0·36
1894	1,387	7	0·50
1895	1,520	5	0·33
1896	1,308	4	0·30
1897	1,521	6	0·39
1898	1,465	3	0·20

A SIMPLE TROUSERS CLASP.

We present in the accompanying illustrations a novel form of clasp invented by Dr. Avediss B. Herald, of Washington, D. C., by means of which trousers can be held in position when wrapped about the leg. The clasp comprises essentially a base plate and a clamping plate hinged together and formed with corrugations alternately with one another, so that the ribs or projections of one plate will enter the sockets or depressions of the other. The base plate has its tip turned out so that it will properly clasp the trousers and avoid injury to the leg. The clamping-plate has its butt end outwardly swelled and returned so as to afford room for the seam at the end of the trousers-leg and to set the two corrugated plates at an angle to each other when



A NEW TROUSERS CLASPING DEVICE.

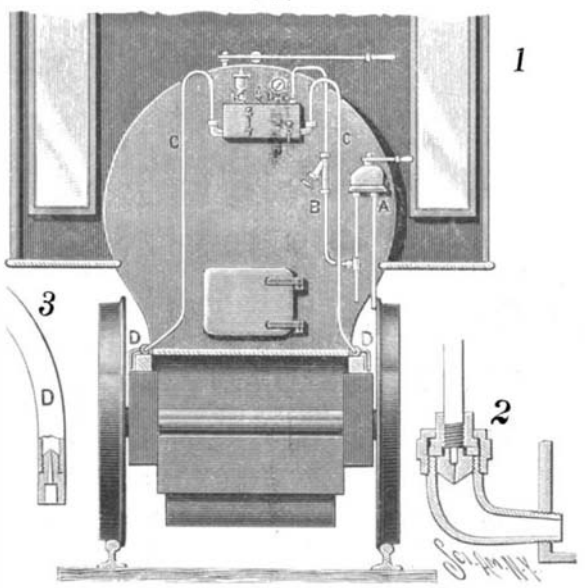
the clasp is closed. About the pintle of the hinge connecting the two plates, a wire spring is coiled with its ends extended to operate the clamping-plate.

The trousers having been folded or wrapped as usual, the clasp is applied so that the base-plate fits within the trousers-leg and the clamping-plate in the loop formed by the fold. The tension of the clamping-plate forces the fold toward the base-plate, thereby securely holding the trousers in place.

AN AUTOMATIC LUBRICATOR FOR LOCOMOTIVES AND MARINE ENGINES.

The lubricating device which forms the subject of the annexed engraving is designed to supply oil continuously and regularly to the bearings or journals of locomotives and marine engines by means of compressed air. The novel features of the invention are found in a peculiar form of nozzle employed, which effectually prevents foreign matter from clogging the pipe. Fig. 1 of our illustrations is a rear elevation of a locomotive cab, showing the device applied to the boiler. Fig. 2 shows part of a feed-pipe and its nozzle. Fig. 3 represents one end of a drip-pipe together with its nozzle.

The oil is contained in a tank secured to the boiler, and provided with a valved feed-cup, a gage-glass to indicate the level of the oil, a cock to permit the escape of air when filling the tank, a gage to indicate the air-pressure in the tank, and a faucet to allow the oil to run off when desired. Connected with the tank near the bottom are outlet pipes which supply oil to feed-pipes, *C*. Each outlet pipe, as shown in Fig. 2, tapers in-



BANGS' AUTOMATIC LUBRICATOR FOR LOCOMOTIVES AND MARINE ENGINES.

wardly and contains within its wider, outer end a nozzle formed with a conical inner end and provided with a straight outlet and a tapering inlet. Wherever a box is to be oiled, the feed-pipe, *C*, is provided with a T-fitting, with one arm of which a drip-pipe, *D*, is connected, extending over the oil-receiver. The drip-pipe, as shown in Fig. 3, is provided with a nozzle similar to that already described, the tapering end likewise facing the direction of supply. The oil is forced through the feed-pipe, *C*, by compressed air, controlled from the engineer's valve, *A*, to which an air-pressure and an air-vent pipe of the usual construction lead.

Owing to the peculiar formation and arrangement of the nozzles, the foreign matter contained in the oil will be deflected to either side of the nozzle, leaving the bore free. An obstruction which enters the contracted end of the bore is forced through the nozzle into the enlarged portion and thence outward, thus insuring a continuous supply of lubricant to the bearings.

The lubricator is the invention of Edwin D. Bangs, of Milwaukee, Wis.

Automobile News.

A large soda water manufacturing firm in New York city has just put into service a very heavy automobile wagon weighing 5,600 pounds. It is driven by electricity.

An automobile club has been formed at Bologna, Italy. There is also one at Nice. According to The Motor Car Journal, there are now 2,173 members belonging to the Automobile Club in France. In one week 99 new names were enrolled.

The Park Commissioner of New York city is issuing permits to automobile owners to the number of two or three a week. Up to the present time only electric carriages have been permitted to enter the Park, as it is thought the gasoline carriages are noisy.

The tour from London to Edinburgh will take place in March. The route will be arranged so as to pass through a large number of places, in order to attract the general attention of the country. There will be several one-day exhibitions at the most important towns.

The Automobile Club, of Chicago, has been organized, and articles of incorporation have been filed. From the large and rapidly increasing number of automobiles in use in Chicago, the club is expected to be a great success. It is proposed to arrange races and tours for automobiles.

Park Commissioner Clausen, of New York city, has granted a permit to a woman to run an automobile vehicle through Central Park. At first he was in doubt as to her ability to manage an automobile, but she invited him to take a ride, and he sent his secretary instead. The latter was speedily convinced of her ability, and the permit was issued forthwith.

The Newport, R. I., plant of the New England Electric Vehicle and Transportation Company is most complete, and vehicles are let with or without drivers. The vehicles are stored in what were formerly horse barns. Ample facilities for charging the storage batteries are provided. The summer colony was most enthusiastic over automobiles, and the demand was so great that it was impossible to care for the carriages during the day only. An electric motor drives an air compressor, which is used to inflate the tires.

A motor carriage has recently been introduced in France which combines many novel features. It is normally propelled solely by an oil engine, but on hilly ground is helped by an electric motor. The oil engine works at constant speed, and when the vehicle does not absorb all the engine power, the excess drives the motor as a dynamo and charges the accumulators. Then the accumulators are only used occasionally and they are kept fully charged. The engine is direct connected to the dynamo-motor, which is shunt-wound, and this is in turn used to start up the engine. The changes in speed are effected mechanically.

On March 1, 1900, the Automobile Club of America will take possession of the famous Kingsland Point, located almost in the middle of the Tappan Zee, on the Hudson River, near New York. Here was built the famous Philipse manor house, in the cellar of which may be found port-holes for cannon. John Brisben Walker has given the use of the Kingsland mansion to the Automobile Club of America, free of rental, for a year. It is twenty-six miles out of New York, and as the roads leading from New York to it are perfect, it will make an ideal run. A terrace, protected by a stone wall, projects into the Hudson in front of the mansion, and in the summer is filled with plants. The entire point is covered by trees of large size, and there is a pavilion over the water. The entire property has 233 acres.

The Fifth Avenue Coach Company, which recently purchased the old Fifth Avenue stage line, has taken the first step toward substituting automobile vehicles for the present stages. A trial of an electrically propelled stage was made January 2, 1900, from the company's stables at Eighty-eighth Street, and it took only thirty-two minutes to run from the stables to the south side of Washington Square, and the return trip was made in thirty-five minutes. There is one seat on the outside for the driver, and at the rear of this is a seat broad enough to accommodate three persons. The inside is finished in oak and will seat eight persons. It is equipped with four inside roof lights, two outside lights, one on either side of the driver's seat, and one portable emergency light, all of course being electric. The vehicle is propelled by a storage battery consisting of 22 cells, the whole weighing 1,500 pounds. The total weight of the vehicle is 5,500 pounds, and the maximum speed is 9 miles per hour. Of course the stage is small and is not exactly what would be used on the line, but it is sufficiently large for experimental purposes.

Science Notes.

Prof. Roentgen has at last decided to accept a call to the University of Munich.

The German Bundesrath has decided to regard January 1, 1900, as the official beginning of the new century.

On December 20 the University of Pennsylvania's Free Museum of Science and Art was formally opened to the public.

According to The Engineer, the horses of the Scots Greys, now at the seat of war, have been dyed khaki color, in order to render them less visible to the enemy.

Prof. Virchow has just celebrated the fiftieth anniversary of his labors as Professor Ordinarius in the University of Berlin. He is now in his seventy-eighth year.

Nearly $30,000 has been raised for a monument to Lavoisier, and it will be unveiled during the Paris Exposition. An open space behind the Madeleine is the site which has been selected.

An English firm that makes scientific instruments now sells quartz fibers commercially. They are specially suitable for suspending heavy magnets, and finer ones suitable for galvanometer suspension are also supplied.

In Finland the newspapers have suffered severely from censorship and suppression. According to Public Opinion, a concern has been formed entitled the "Finland Newspaper Press Censure Insurance Company." It guarantees an indemnity not exceeding 60 per cent of the loss of the gross income incurred by suspension. The premium is 5 per cent of the gross income.

According to The Philadelphia Ledger, the police of a small Pennsylvania city were much mystified by finding boys fast asleep and in a semi-conscious condition stowed in vacant houses, sheds and brickyards. It was finally discovered that the boys had gotten into this condition by inhaling the fumes of gasoline, and some of them have really become gasoline drunkards.

The Druggist's Circular translates the following from a French contemporary. It states that if a few drops of a solution of indigo carmine are added to milk, the color produced by it disappears under the action of the microbes in the milk. He determines the age of milk by the duration of the tint; thus, if fresh milk it lasts about twelve hours at 15° C.; five hours at 15° to 20° C., and four hours at 20° C. Where there are several decigrammes of the lactic acid to the quart of milk, the tint vanishes almost instantaneously. This, of course, can apply only to milk which is not protected by an anti-ferment.

In a theory of wind instruments proposed by F. Larroque, it is assumed that the tubes of brass instruments consist of a conical part with its vertex at the mouth of the player, and an enlarged portion at the further end. The effect of the enlarged end is to emphasize the higher harmonics, for the pitch of the note is not altered if the cone is continued in its regular shape to the end of the tube. The portion situated between the cone and the brass resounds to the notes produced in the tubes and strengthens them while increasing the expenditure of wind. An increased expenditure of power implies an increased prominence of overtones.

Consul Hughes sends the following from Coburg, October 23, 1899: A simple method of preventing rot and other diseased conditions of winter seed potatoes is in use by the peasants of Thuringia. Those potatoes that rot easily in the cellar in winter are made better able to resist disease conditions and cold by being laid in a sunny place, as far apart from each other as possible. They are turned over morning and night until they become thoroughly green, and are then placed in the cellar for the winter. Potatoes treated in this manner do not rot and can withstand a great amount of cold without freezing. Early potatoes thus treated do not sprout in the cellar, and so retain their full strength. In February, the potatoes are taken from the cellar and put in a partially warmed room until planting time. When planted, they will sprout stronger and quicker than potatoes not so treated, and the crop will be larger and better.

A few weeks ago we described a large poster which was pasted on the pavement between the car tracks at Battle Creek, Mich. A correspondent writes us that this is remarkable, merely as a piece of what might be called the playful side of the printing business, but that it is an abuse of the word "poster." He calls our attention to some very remarkable posters. About 1883 a poster was designed and issued by a Cincinnati firm which contained a hundred sheets each 30 × 40 inches in size. The poster was nearly 85 feet long and 10 feet high and the pictures consisted of one single scene—a circus interior. It was a complete single picture from end to end. There are a large number of 36, 40 and 48 sheet posters produced annually, but larger ones than this are rare on account of the difficulty of posting. One or two great circus companies use regularly posters containing sixty-four sheets bearing a single complete scene.

Engineering Notes.

Four hundred and seventy-two miles of new lines were opened in Japan during the year ending March 31. There are now 2653 miles of railroad in operation.

Benzine motors are being tried for driving canal barges in France. The motors are of about 12 horse power and drive twin propellers. The speed is said to be considerably greater than where horses are used on the towpath.

It is said that the government purchases about 10,000 typewriters per annum, and the administration is about to make a systematic attempt to secure a considerable reduction in the price of the machines by clubbing the orders together.

The American Line has arranged with the underwriters for extensive repairs to the steamer "Paris." The boat will be refitted with new engines similar to those of the "St. Louis," and she will be ready for service within a year. The name of the vessel will be changed and she will be called after some American city.

The Philadelphia and Reading road has recently installed a novel method of ventilating several of the smoking cars. It consists of three two-bladed vanes suspended from the top of the ventilators and operated by a small motor actuated by wind created by the motion of the train. The result is a continuous circulation of air, and the smoke and bad air are taken out through the ventilators. The fans may be disconnected when desired.

The Russian government is preparing to construct a new railroad going from the south of European Russia to Turkestan. It is intended to connect the commercial centers of Russia with Central Asia by the shortest route. Two projects exist, and neither of them has been finally decided upon. Either one would be less costly than the Siberian railway, and the natural resources of Turkestan territory are scarcely inferior to those of Siberia.

The new bridge which will connect Boston with Cambridge has been designed with a view to artistic effect, and, according to The American Architect, if the present plans are carried out, as is probable, the structure will not only be interesting, but creditable to both cities. The bridge is to be adorned with lighthouses near the center, and two towers near the end. As the length of the bridge will be considerable, this will prevent a crowded effect.

A list of guns in possession of the Boers has been published on what is said to be trustworthy authority by the National Zeitung. According to this account, the Boers have eight 7·5 cm. Krupp guns, sixteen 7·5 cm. Creusot guns, eight or nine Maxim-Nordenfelt field guns, twenty-four 3·7 cm. automatic Maxim guns, eight 12 cm. field howitzers—four from Krupp and four from Creusot—four 3·7 cm. Krupp mountain guns, four 15·5 cm. Creusot guns. In all, with old guns, the Boers possess some eighty or ninety pieces of artillery. During recent years the Boers are said to have bought 40,000 Mauser rifles, and 25,000,000 cartridges, as well as a large number of Martini-Henry rifles.

The "Pioneer," the first regular sleeping car built by the Pullmans, has been definitely retired from service, says The Railway Age. On one other occasion it was retired, but was again pressed into service for the transportation of troops during the war with Spain. It was built about the year 1858 in the shops at Bloomington, Ill., at the cost of $18,000, and made its first trip on the Chicago & Alton Railway. The cost of construction was at that time regarded as extravagant, but the immediate popularity of the accommodations afforded by it, created the demand for the present system. The car appears shabby, small and inconvenient, but the fundamental ideas embodied in the construction of the present luxurious cars seem present to a surprising extent in this prototype of modern cars, so that the name "Pioneer" appears to have been prophetic.

The inventor of the "Raddatz" submarine boat and two engineers recently had a thrilling experience in their odd craft. For some weeks Mr. Raddatz has been engaged in surveying the bottom of Lake Michigan off the entrance to Milwaukee Harbor. At one place the boat was sunk in what afterward proved to be a depression in the bottom. Supposing that the ground was comparatively level, Mr. Raddatz ordered the craft ahead, when suddenly she thrust her pointed prow into a submarine bank. As the vessel was moving at a speed of four miles an hour, the shock was quite severe. The boat was stuck fast, and it was only after half an hour of the vigorous use of the propeller that she was loosened. The same day they were caught by sticky clay three miles from the entrance of the harbor. The occupants of the boat were caught much longer than before. Fortunately no injury was done to the machinery, and the trouble was caused by permitting the vessel to rest too heavily on the sticky clay. Finally the boat succeeded in lifting itself clear of the dangerous bed. The surveys which have been made with the submarine boat have amply demonstrated its usefulness.

Electrical Notes.

The Southern Railway is having 41 locomotives built in Richmond, and each is to be equipped with an electric headlight.

In laying a new fire alarm cable between Randall's and Ward's Islands and the main line of New York, a locomotive was used in hauling the cable into place. The engine performed the work with ease.

At the Henry celebration held by the citizens of Albany, December 16, President Verplanck Colvin of the Albany Institute read a letter from President McKinley in which he spoke most highly of the good work done by the late Joseph Henry in developing telegraphy.

In the electrical extraction of mercury the cinnabar ore is crushed to a fine state of division and is then treated with a hot solution of sodium sulphide containing sodium hydrate. The electrolytic vats are of iron and may be used as cathodes. The anodes are made of steel.

The extension desk telephone is constantly growing in favor. It saves the annoyance and delay of having to rise and go to a general office telephone. As the message comes over the general telephone line, the business man having the extension desk telephone can answer the call or not as he may see fit.

Tests of wireless telegraphy are being made across Lake Michigan. There is a car ferry operated by the Ann Arbor Railroad, and at present they are obliged to telegraph between the two ferry houses by way of Chicago, and the delays are enormous. It is hoped that wireless telegraphy will solve the problem of rapid communication for them.

The cost of the Yukon telegraph lines was about $137,000. The distance from Lake Bennett to Dawson is 740 miles. There were no horses engaged in carrying on the work of construction, most of the carrying being done by scows on the river. According to The Electrical World, $400 was taken in for messages on the first evening the lines were opened.

It has been discovered in St. Paul that electric ground connections made by attaching wires to water pipes not only ruin the pipes themselves, but also seriously interfere with the operation of the water meters. In one case the meter failed to register, notwithstanding the fact that large quantities of water flowed through it. The officers of the Water Board have ordered the removal of all electric wires from the water pipes.

The Manhattan Elevated Railway Company of New York has announced that the contract for the generators for the new power plant and the apparatus for the sub-stations has been awarded to the Westinghouse Company. The first of the dynamos is due for delivery in ten months, so that there is a probability that a portion of the Manhattan Railroad will be operated by electricity next year. Electrical equipment on the Kings County Elevated Road in Brooklyn is now completed so far as the Coney Island section from the Bridge up is concerned, and the cars make excellent time.

In connection with the transmission of current of high potential by the Union Carbide Company, of Niagara Falls, the current is stepped down from 11,000 volts to 2,200 volts at the works by means of seven transformers each of 2,500 horse power capacity, says The Engineer. These transformers are double the size of the largest hitherto constructed. The total weight of each unit is twenty-two tons, of which one-half is made up by the sheet iron used in the core. The clamps for holding the latter together weigh nearly two tons. The inclosing case is about 11 feet high and 8½ feet by 4½ feet in plan. The transformers are immersed in oil, which is cooled by water circulating through 650 feet of piping. The energy in the form of heat which must be disposed of in this way amounts to over 40 horse power at full load.

Commercial Intelligence quotes from the Eleckt. Zeits. that an association of farmers in the district of Ochsenfurt (Bavaria) is erecting large electrical works near the village of Bütthard, in Lower Franconia, which will be entirely devoted to agricultural uses. The current is produced close to the village of Schäftersheim, a distance of 11 kilometers, requiring for its creation a force of about 150 horse power, which is supplied partly by steam and partly by water, and conducted as current of 5,000 volts to the villages of Bütthard, Laudenbach and others, where it finds the most varied use. Movable electromotors for driving thrashing machines, chaff cutters, bruising mills, etc., are supplied, and connecting boards for the conducting wires are placed at every farm. The motors are of very simple construction, and can be easily handled by any of the farm hands. The electric light will be widely used in all the villages named, and on account of greater security with regard to fire in the lighting of agricultural buildings, it is daily increasing in use among farmers.

HOMEMADE WINDMILLS IN NEBRASKA.

In the current issue of the SUPPLEMENT we begin a most interesting series of articles on "The Homemade Windmills of Nebraska," by Erwin Hinckley Barbour. The articles will run through several numbers and will be accompanied by over thirty illustrations. To those who may be unfamiliar with these windmills they will be a revelation, and the importance of this movement inaugurated by the inventive farmers of Nebraska is made manifest, in that many acres of garden truck, fruit land, and even farm land are irrigated at a trifling expense. Stock is supplied with water, ranchmen and sheepherders are benefited, dairy products are increased and improved, and the comfort of the village and the rural home is often enhanced. The merits of these homemade mills have enjoyed such prompt recognition that they are going up daily, not to the detriment, however, of windmills which are made by regular manufacturers, but in addition to them. In a given community the man who puts up the first mill generally furnishes the model for the rest of the neighborhood, hence it seems desirable that good models should be used, as illustrated in Mr. Barbour's paper. All of the leading types are shown, and they may serve as models, and with the aid of a few types, almost anyone can construct windmills which will prove of substantial benefit to their constructors. The author has visited a large number of mills in various parts of the State of Nebraska and in other States, and his writings on the subject give proof of an intimate acquaintance with the subject.

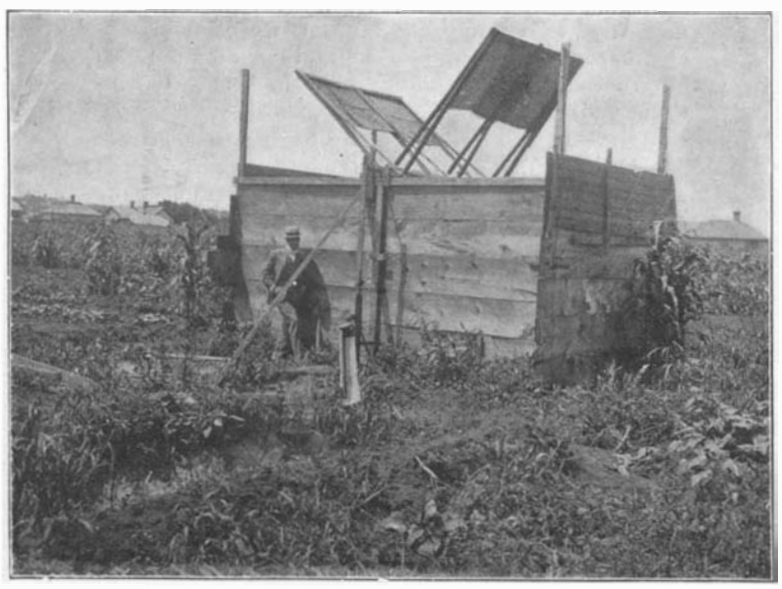
The builders of homemade mills in Nebraska are generally the wealthy and more progressive among the older and well-established farmers or else younger men just making a start, and not the roving, unsettled or shiftless class. Some of the beginners use the homemade mill for the irrigation of the garden and for supplying the house, and others make luxuries of them rather than necessities. They put them to work in various ways to save hand labor, such as running a grindstone, churning, working a feed grinder, corn sheller, the wood saw and other farm machinery. The cost of these windmills is not great. In dollars and cents the average mill will not fall far from four or five dollars, not including the labor. Such mills are usually put up at odd times and made out of material at hand, such as old lumber, poles and hardware common to every farm. Some builders by a display of superior management erect excellent mills at a nominal extra expense of one or two dollars for labor and hardware. Some mills will be found doing good service which cost but $1.50, and from this there is every gradation in the price of mills up to $150, which gives an efficiency of 8 horse power and is capable of grinding food for the stock at the rate of 200 to 300 bushels of grain per day, according to the wind.

Mr. Barbour divides the mills into "Jumbos," "Merry-go-Rounds," "Battle Ax," "Holland" and "Mock Turbines." This includes all of the main types of the homemade mills known at present.

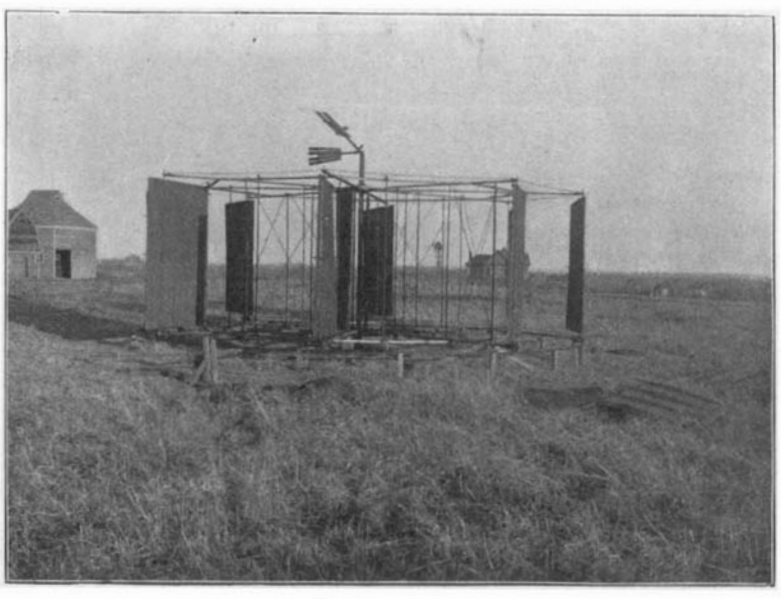
The "Jumbo" or "Go-devil" as some call it is very like an old-fashioned overshot wheel. They lend themselves readily to construction, being very simple in design, and they are very economical, owing to the fact that old lumber, laths, shingles, split rails, tin from old roofs, etc., can be pressed into service in the construction of these mills, and even the useful tin can unsoldered can be utilized for nailing on the loose sides of the Jumbo box. The efficiency of the Jumbo mills is low, but this is compensated for by the fact that they are comparatively inexpensive to build, for a good mill of this type can be built for $3, and a better one for $8. Some have been built large enough to irrigate ten acres of orchard. The smaller Jumbos, termed "Baby Jumbos," are very small mills. They are generally mounted on abandoned towers or upon buildings, while the larger mills of the same class are set upon the ground and securely anchored there. They are all set so as to catch to best advantage the prevailing wind of the place, which is north and south in Nebraska.

The construction of the Jumbo mill will be understood by reference to our first engraving, which shows one which was made at an expense of $8. The sails are made of old coffee sacks, and the cut-offs or wind guards may be seen at either side. They are raised and lowered by pulley and rope. The dimensions are 13 feet long, 9 feet wide and 13 feet high. This mill successfully irrigates a five acre garden. The reservoir supplied by this mill is 150 feet long by 4 feet wide and 2 or 3 feet deep. The sliding doors may be raised or lowered so as to cut off more or less of the force of the wind from the fans, as is rendered necessary by winds of varying velocities. Sometimes these Jumbo windmills are built one north and south and the other east and west, so as to insure service whatever the direction of the wind.

In the "Merry-go-Round" mill is found another attempt at the construction of mills of unlimited size. These mills are rather complex in construction and are not put up by the farmer, but by a carpenter and at a considerable expense. Mounted upon towers like ordinary turbine mills of the manufacturer, they soon reach a size at which the wind can upset them, however well anchored. This has led to the towerless mills which stand low upon the ground, and consequently are capable of a greater circumference. These mills consist of a number of fans revolving about a central axis. About the same axis usually revolves a semicircular hood, thus exposing half of the fans and shielding the other half, the shield running upon friction rollers. When the mills are to be thrown into gear, the cord simply revolves until it covers all the fans on the windward side. Small and medium sized mills may be constructed in this way. A larger Merry-go-Round is that built by S. S. Videtto on a ranch near Lincoln, Neb.; it is shown in our engraving. This mill has a diameter of 40 feet and the fans are 12 to 14 feet high. The whole structure is carefully designed and well made, being solidly braced, and runs upon a circular steel rail. This is an experimental mill, and it is hoped that this or some other equally powerful mill may yet be perfected.



HOMEMADE "JUMBO" WINDMILL, LINCOLN, NEBRASKA.



A "MERRY-GO-ROUND" WINDMILL, LINCOLN, NEBRASKA.

Mr. Barbour then goes on to describe turbines or open-faced mills, which include the "Battle Ax" mills, the "Holland," which resembles the well-known type used in Holland, and the "Mock Turbines," which resemble the manufactured article so closely as to be scarcely distinguishable at times. The subject is a most interesting one, with which all our great agricultural class should be acquainted.

Manila Hemp.

In one product, at least, the Philippines lead the world. Nowhere else has it been found possible to produce a quality of hemp to rival that grown in some of the Philippine Islands.

The hemp industry is not one of very large proportions, nor is it one capable of indefinite extension, for the possibilities of production endlessly outstrip the probabilities of consumption, and this fact must be taken into consideration. Thus far, says The Evening Post, from which we glean our facts, little or no use has been found for hemp fiber, save in the line of twine and cordage, although it probably has some possibilities in the line of woven cloths for special purposes. The annual output of Manila hemp may be taken roundly as 100,000 tons. The value ranges from $45 to $100 per ton, and the average total value of the product may be taken as approximately $8,000,000. Unless some new use can be found for the material, any great increase in the production would tend to a reduction in price by which it could be brought into competition with materials now used as substitutes, and the loss would lie with the producer.

The methods employed are of the crudest. The plant belongs to the plantain or banana family, which sends up a stout trunk or stalk which reaches its maturity in three or four years. The stalk will run from six to eight inches in diameter and is crowned with long, massive, and arching leaves which are so well known by illustrations. There is a central body of pith in the stalk surrounded by filaments embedded in sappy, vegetable matter. The filaments constitute the hemp of commerce, and their extraction from the stalk constitutes the process of hemp production. The cutting is done with a single stroke of a knife which corresponds to the Cuban machete. The fallen stalk is stripped of the fiber-bearing petioles, which are cut into ribbons five or six inches in width, and of a length determined by their growth. The next process is where it invites and demands the genius of the inventor to devise an instrument or chemical process by which the sappy vegetable matter may be separated from the fiber without injury to the latter. In the present system a rude trestle is constructed supporting a knife secured by a hinge at one end while the other is operated by the upward pull of a flexible stick, acting as a spring, whose force is counteracted by attachment to the treadle controlled by the foot of the worker. Thus, by gradually releasing the pressure, the operator regulates the bearing force of the knife and overcomes the inequalities of thickness. There might be some difficulty in the construction of a machine which will adjust itself automatically to the various thicknesses of the petioles and the varying tensile strength of the fiber. It must also be free from danger of discoloring the fiber, to which it is very liable and which lowers its market value. The denuded fiber is then dried and is ready for the market. The material arrives in small, rough bundles, in which it is packed by the peasants. It is sorted and weighed out in lots weighing 280 pounds for baling. These lots are stowed in roughly-made cribs and are then trampled down under the feet of the men, who jump and dance upon it until there is a suitable quantity in the crib. The crib is then moved under a rude screw-press operated by four men, who stand on a platform and turn the screw by means of capstan bars. A more powerful screw-press worked by twenty or thirty men is then used. After the mass is reduced to the proper size, it is bound with bamboo, and the bale of hemp is ready for marketing and shipment. It would seem to be an excellent opportunity to introduce American presses.

Discovery of New Invertebrates in the Dinosaur Beds of Wyoming.

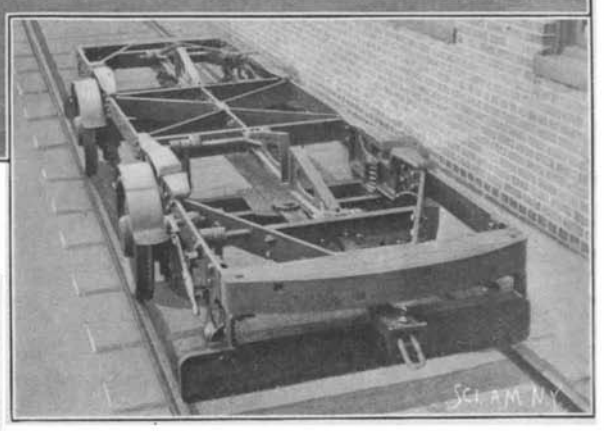
Prof. E. H. Barbour, of the University of Nebraska, in an address delivered August 25, 1899, at the Ohio State University, Columbus, O., before the Geological Section of the American Association for the Advancement of Science, states that it will undoubtedly be of interest to this section of the American Association to learn of the discovery of a bed of invertebrate fossils in the Dinosaur beds of Wyoming. Hitherto almost no invertebrates have been reported from this bed. It was my privilege to accompany the Fossil Field Expedition, sent out by the courtesy of the Union Pacific Railway Company, July 21, 1899. In company with Prof. Knight, director of the expedition, while locating Dinosaur bones, we came unexpectedly upon a small exposure of very fossiliferous limestone of compact crystalline structure.

The fossils were admirably preserved in this dense matrix, and it is possible with study to make out their minuter structure. Superficial examination goes to show that these fossils are fresh water forms, and to that extent the prevailing idea of the fresh water origin of the Dinosaur beds is substantiated and sustained. It is safe to say that in the large amount of this material collected some eight or ten species, possibly several more, can be made out, when it is worked over in the laboratory. In the field we were able to recognize at least three distinct Lamellibranchs. The external and the internal markings are sharp and distinct, so as to admit of exact determination. Of the Gasteropods there were at least three and probably five distinct forms, all small but finely preserved. Besides there were several teeth (Crocodilian) and fragments of bone. Later, when the boxes have been unpacked and the material worked over, a formal report with list of genera and species will be submitted.

THE BONNER RAIL WAGON.

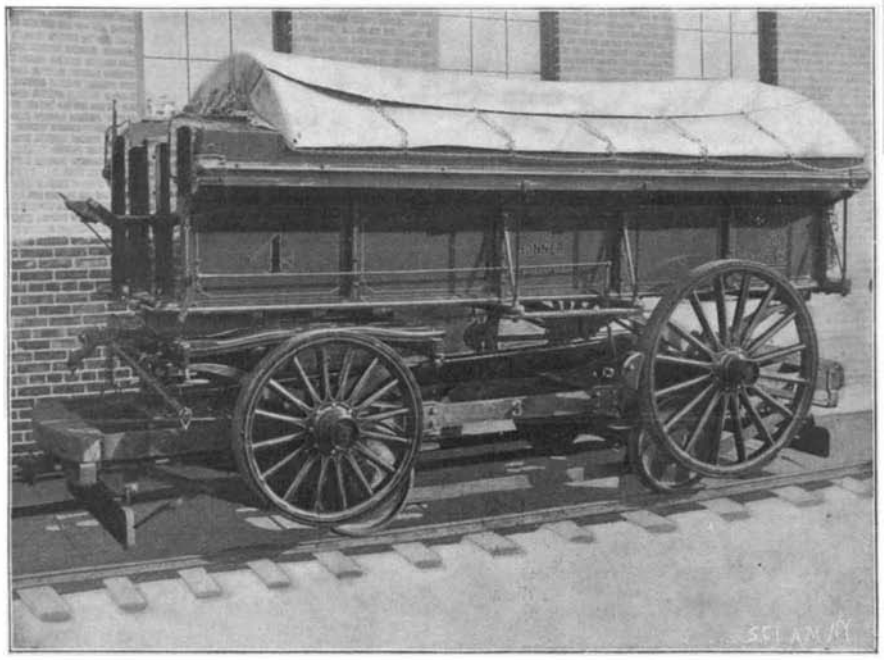
In the very earliest days of railroading it was customary for the traveler to drive up to the railroad station in his own private coach, and have said coach and its passengers transferred to one of the railroad wagons, which would be coupled to the train and take the coach and its occupants to their destination. Probably our readers will have seen some of the prints showing the pioneer trains in England, in which three or four private coaches of the kind that ran upon the highways in an early day are shown mounted upon railroad trucks and making the journey as part of the train. For obvious reasons, as railroad passenger traffic increased, the practice was discontinued; but the custom left its imprint upon the standard passenger "coach" of the English roads, which for many years bore a close resemblance to the stage coach of highway travel. For the carrying of freight, however, this custom of transporting the vehicle and its load entire still exists in England in the matter of furniture removal, the furniture vans being run onto special trucks at the railway yard and carried by rail to the desired town, a system which saves two rehandlings, and enables household goods to be loaded at one home, carried for hundreds of miles, and unloaded at another home without the door of the furniture van being once unlocked.

1.—RAIL WAGON HAULED UP INCLINED PLANE, CLEAR OF TRUCK.



2.—THE TRUCK, SHOWING RAIL WAGON STOPS AND LEVERS TO OPERATE SAME.

The accompanying views of the Bonner Rail Wagon represent a very successful attempt to cheapen the transportation and handling of freight in connection with the electric trolley roads which have become such an important feature of modern transportation. The wagon has been designed to enable a load of freight to be hauled by teams to the nearest electric road, carried by the same to the village or town to which it is consigned, and then hauled to the particular consignee, all without rehandling, the load remaining unbroken in the wagon from the time it is loaded until the time it is discharged. The vehicle is really a combined road wagon and railway truck, animal power being used in the streets or on the highways, and electric, steam, or other motive power being substituted on the rail trucks. The combination vehicle is patterned after the best form of farm or city freight wagon. It is supplied with the usual, but in this case particularly substantial, running gears, and it is built with a carrying capacity of from 2 to 8, or even 10 tons, according to the character of the freight to be hauled. For service on the streets or highways it is provided with the ordinary wide-tire road wheels, but when transferred to the rails it is carried on a special rail truck of the proper gage of the railroad.



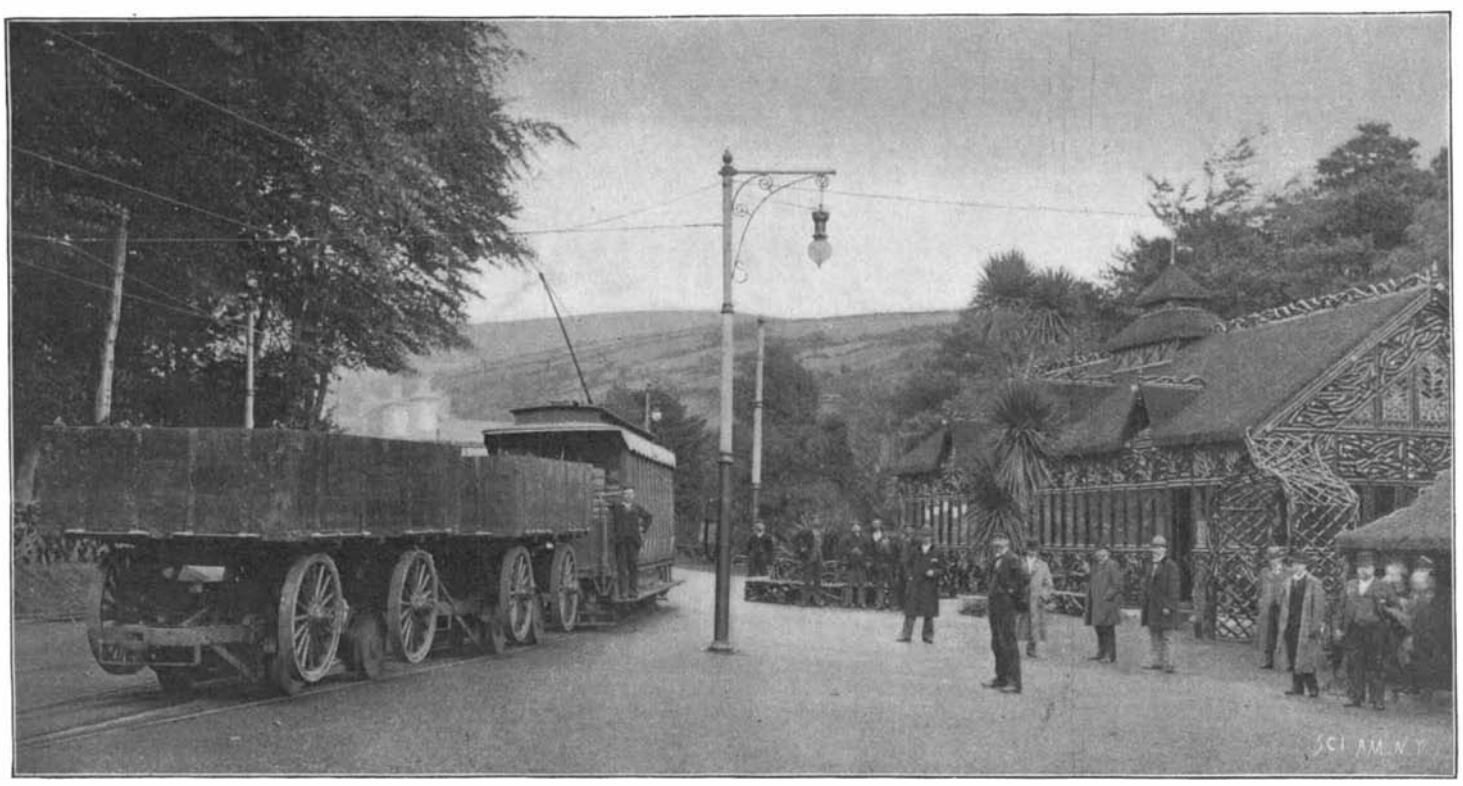
3.—RAIL WAGON MOUNTED ON TRUCK.

The truck which is shown in Fig. 2 consists of a stout and well braced frame carried upon two axles and provided with two pairs of stops which are located in positions corresponding to those occupied by the axles of the road wagon when it is in place on the truck.

The stops are operated by hand levers, one of which will be noticed at the side of the truck. At each transfer station on the electric line an inclined driveway is arranged, which is of the same gage as that of the wheels of the road wagon, the tracks of the driveway being placed on the outside of the tracks of the electric line, as shown in Fig. 1. The wagon is hauled by the teams onto the driveway, where the axles engage the stops of the truck; and as the wagon descends the driveway the axles settle upon the truck in their proper position, the road wheels swinging clear of the ground and leaving the wagon entirely supported by the truck, as shown in Fig. 3. The rail wagon can now be hauled by an electric car to its destination and, if desired, a regular train of four or more vehicles can be made up in this way.

The advantages of the system are many and obvious. It secures a large saving of time and expense in loading and unloading, and, what is even more important, the freight can be hauled not only at greater speed, but at considerably less cost on the tracks than it could be hauled by teams on the roadway. The system has been designed by Col. Joseph C. Bonner, of Toledo, Ohio, where it is in successful operation, the mileage covered to date being considerable. Contrary to the expectations of the railway managers, who supposed that electric railroads would be confined to the handling of small parcel packages in the way of express business, the freight carried by the wagon train service at Toledo, and also at Detroit, Michigan, shows that the shipments average in weight over 400 pounds each, and that they frequently aggregate from 4 to 8 tons bulk loads.

Our illustration, Fig. 4, shows a rail wagon train at Laxey Glen, Isle of Man. The length of the Isle of Man Tramways line over which the rail wagons operate is about 25 miles. The line is a continuation of curves and inclines, with gradients as steep as 1 in 24. A large amount of the freight traffic consists of hauling granite from quarries owned by the tramways company to the shipping dock. The rail wagons convey each load of 6 tons direct from the quarries to the dock, whereas hitherto it has been the custom to cart the granite to and from the railway cars in one-horse two-wheeled carts, the average load being 1,700 pounds. The Rail Wagons and Trucks are manufactured by the Bonner Rail Wagon Co., of Toledo, Ohio.



4.—RAIL WAGON TRAIN AT LAXEY GLEN STATION, ISLE OF MAN.

U. S. Naval Attaché Beehler, who attended the first annual meeting of the Society of Naval Architects at Berlin, expresses the opinion that the German Department of Naval Construction is now superior to the naval schools at Glasgow and Paris, and advises the United States government to send our naval constructors there rather than to Great Britain and France.

A 70,000 HORSE POWER CENTRAL STATION.

There is now in active operation in New York a power station which will ultimately contain by far the largest aggregation of horse power ever gathered at a single station. About half of the total number of units, which will have a combined horse power of about 70,000, has been installed, and the others have been ordered and are now being built by the Edward P. Allis Company, of Milwaukee, Wis.

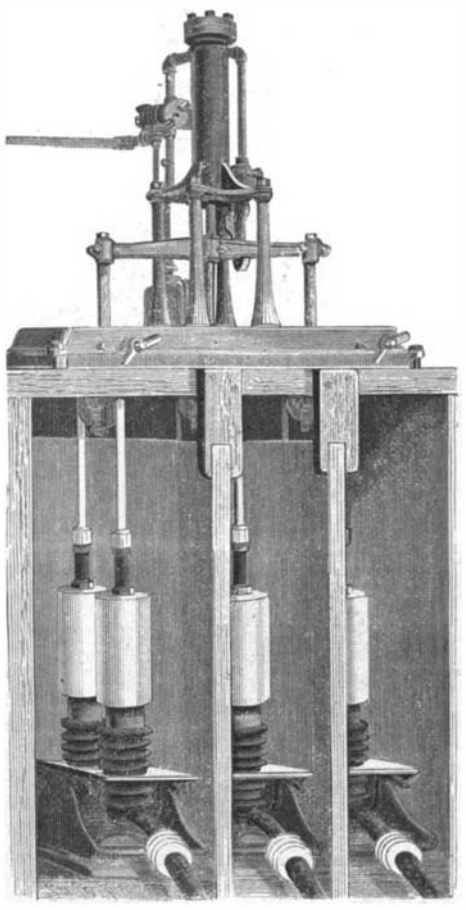
It is scarcely necessary to say that the construction of a power station of such unprecedented proportions is not prompted by any mere desire to eclipse all existing plants, but has been determined by strict economic considerations. The station was designed for the purpose of supplying electric current for the 220 miles of track of the Metropolitan Railway Company, which are to be operated by the underground trolley system. A few years ago such a scheme would have been impossible to carry out, as the low-tension currents in use at that time would have required the construction of several independent stations scattered throughout the city. The introduction of the alternating current, however, made it possible to generate the whole of the required current at one mammoth central station, transmit it at high voltage to substations located at convenient points on the system, and there reduce it to 500-volt direct current for the operation of the trolley cars.

The power station, of which we give both an exterior and an interior view on the front page, is located between Ninety-fifth and Ninety-sixth Streets on the East River. It is a very imposing structure and measures 279 feet on Ninety-fifth Street, and over 200 feet on First Avenue. It is divided into an engine and a boiler room by a brick wall partition, the engine room being 111 feet in width, and the boiler room 84 feet. In preparing the foundation of the power house, 7,854 piles were driven over the whole area to an average depth of 35 feet, and above this was laid a bed of concrete 5 feet in thickness, the concrete beneath the big stack being 20 feet in thickness. The boiler room has three floors on which are located 48 boilers of the Babcock & Wilcox type. Each boiler has 2665·5 square feet of heating surface and the steam pressure is 160 pounds. Through the center of the boiler room and adjoining the partition wall rises the huge smokestack, 353 feet in height, which is one of the largest structures of the kind in the world. It was described in detail in an illustrated article on the power house given in the SCIENTIFIC AMERICAN of November 12, 1898. Above the boilers are two unusually large coal bins with a combined capacity of 10,000 tons. The coal is brought alongside the power station dock in barges, where it is unloaded by a mechanical coal-handling system which carries it by conveyers to the coal bins.

Our engraving of the engines represents the main floor of the building, beneath which are a basement and a sub-basement. The steam pipe, feed water heaters, condensers and air and circulating pumps are located in the basement, while in the sub-basement are the pipes for the condenser water, and the electric cable conduits. In the engine room will eventually be located eleven Allis, vertical, cross-compound, condensing direct-connected engines which will have a capacity at 50 per cent overload of 6,600 horse power each, making a total capacity for the whole engine house of about 70,000 horse power. Each engine stands upon a massive brick foundation measuring 28 × 43 feet on the base, and rising to a height of 29 feet above the concrete floor. It took 450,000 bricks to build each pier, making a total of nearly 5,000,000 bricks for the foundation of the eleven engines. The engines are set up in two parallel rows which extend the full length of the engine room, one row containing five units and the other six. Our front page illustration shows the two engines which stand at the head of each line, near the western end of the power house. The high pressure cylinder is 46 inches in diameter, the low pressure 86 inches, and the common stroke is 60 inches. The engines are run at 175 revolutions, at which the piston speed is 750 feet per minute. With a view to reducing the clearances to a minimum, the valves are placed in the heads of the cylinders. They are driven by the Reynolds-Corliss gear with separate wrist-plates for steam and exhaust valves. The steam cylinders are not jacketed, but a large reheating cylindrical reservoir, which will be noticed in the farther engine in our illustration, is placed between the high and low pressure cylinders. All the wearing surface of the engines are of very liberal proportions. Thus the bearings of the engines are 34 inches in diameter by 66 inches in length, and the cross-heads and crank-pins measure 14 × 14 inches. The fly-wheel, which is 28 feet in diameter, is of steel. It was cast in ten sections and weighs 150 tons. Each section consists of an arm and rim. The arms are bolted to the hubs, and the rim segments are connected by links of steel, 5 inches deep by 10 inches wide. After the wheel was erected, the rim, which is 29 inches deep by 10 inches wide, was widened by building up on each side of it eight circles of 1⅛-inch steel plates, which were riveted on by means of 3-inch steel rivets. The engine shaft is of fluid compressed steel. The outside diameter is 37 inches at the fly-wheels, 34 inches at the journals, and 30 inches at the cranks, and it measures 27 feet 4 inches in length. A 16-inch hole extends through the whole length of the shaft. The fly-wheel, cranks, and the generator spider were forced on the shaft by hydraulic pressure after the parts had been assembled at the power-house, the pressure used being 5½ tons to the square inch.

The condensing water for the surface condensers is drawn from the adjoining East River. It should be mentioned that each engine is provided with an independent air and circulating pump and with a Worthington condenser. Each air pump discharges into its own hot well in the basement, and each hot well connects with two equalizing tanks. From these tanks the boiler feed-water is taken. On its way to the pump the water from the equalizing tanks is drawn through the primary feed water heaters, which are warmed by the exhaust steam of the main engines. After passing the pumps the water goes through the secondary heaters, which are of the Goubert type, and from them it passes to the boilers. The secondary heaters are heated by the exhaust steam from the auxiliary engines of the power house.

Mounted on the crank-shaft and adjoining the fly-wheel of each engine is a three-phase generator, with a normal capacity of 3,500 kilowatts at a speed of 75 revolutions per minute. Current at a pressure of 6,600 volts is transmitted from the generator to the substations to which we have already referred. The generators are of the revolving field type with an external stationary armature. The field ring carries 40 poles and the field coils are supplied with current from two 160-kilowatt and one 75-kilowatt generators. The step-down transformers at the substations are rated at 350 kilowatts and the rotary converters at 990 kilowatts with a pressure of 550 volts. The rotary converters are of the revolving armature type. We present an illustration of the pneumatic oil switch for breaking the circuit on the main line, which, as we have said, carries an alternating current of 6,600 volts. The lower part of the switch containing the contact points is carried within a case, which is walled in with brickwork. Above the case is a vertical pneumatic cylinder whose valves can be operated from the electrician's desk. The piston rod carries a crosshead, to which are attached three vertical insulated rods. Each rod supports two copper contacts which enter the brass cylinders through insulated stuffing boxes (as shown in the engraving), and engage split spring copper sockets, into which they slide. The cylinders are filled with oil. By admitting air below the pneumatic piston, the copper contacts are raised clear of the sockets and the 6,600-volt circuit is broken.



PNEUMATIC OIL SWITCH.
Metropolitan Street Railway Company Power Station.

As may be judged from the first page engraving, the interior view of the engine room is very impressive. Fifty feet above the floor a 30-ton, electric, traveling crane spans the entire room, and the admirably designed steel truss roof at its loftiest point rises 90 feet above the floor. The figures on the two platforms and on the floor serve as a scale to indicate the massive proportions of these engines, which weigh complete, with generator, 700 tons and have a clear vertical height of 38 feet above the floor, or of 65 feet measured from the base of the brick foundations. The plans of the station were prepared under Mr. F. S. Pearson, the consulting engineer of the M. S. Railway Company; and we are indebted to Mr. M. G. Starrett, the chief engineer of the company, and Mr. J. D. Lamden, the chief engineer of the station, for courtesies extended during the preparation of this article.

Carbonic Oxide Absorbed by Plants.

In his presidential address, delivered before the British Association, Mr. Horace Brown gives an account of the experiments which he has carried out in order to determine the conditions under which the carbonic oxide of the atmosphere is absorbed by the leaves of plants. He finds that the surface of the leaves absorbs the carbonic oxide at about one-half the rate at which the same gas would be absorbed by an equal surface kept constantly wet with a solution of caustic alkali. He considers that the gas penetrates only by the mouths or pores of the leaf, these occupying a relatively small proportion of the surface. He makes some calculations as to the rate of speed with which the carbonic oxide passes through the pores, and finds that in the case of the plant under consideration, a variety of the catalpa, the gas must pass at the rate of 150 inches per minute. To imitate the action which takes place in the leaf of the plant, he has carried out a series of experiments, using a recipient containing an alkaline solution and provided with openings of various diameters. In this way the speed of penetration of the carbonic oxide is found to increase very rapidly, as the diameter of the aperture is lessened, and for minute openings this speed is necessarily very great. Mr. Brown has also made determinations to find out what proportion of the solar energy is utilized for the vital processes of the plant. This proportion is much greater in diffused light than when the leaf is exposed to the direct light of the sun. In the former case he estimates that 95 per cent of the energy absorbed may be utilized; of this, 2·7 per cent represents the work of assimilation and the remainder is used for evaporation of the water contained in the leaf. In the second case, that of exposure to direct sunlight, only 28 per cent of the energy was utilized, and for the work of assimilation but ½ per cent. Among other calculations, he estimated that 6·5 per cent of the total energy of solar radiation consists of rays which are capable of being absorbed by the chlorophyl of the leaf.

New Photographic Developer.

A new developer has lately appeared which is said to give very good results, and to be equal to hydroquinone, if not superior. The body, which has received the name of audriol (Audriol), is a derivative of hydroquinone, and seems to have all the good properties of this body, without its defects. It requires but a small quantity of alkali, and the potassium carbonate may thus be replaced by sodium carbonate, which is less corrosive, while the use of caustic alkali becomes unnecessary. In spite of the small quantity of alkali used, the image comes up more quickly than in the case of hydrochinon. It is also to be remarked that low temperatures within ordinary limits have little or no influence in retarding the development of the image as a whole or the details. The principal quality of audriol is its great developing power, which is not equaled by hydroquinone, even with the use of caustic soda. It has the valuable quality of working up to the end of the development without fogging the plate, which renders it superior to most of the other developers in this respect. The image appears normally in about twenty seconds, and comes up uniformly; after about four minutes it has gained the desired intensity in the high lights as well as in the details.

These latter came up regularly as the development proceeds; in this way the final result is a plate which presents a harmonious appearance, rather soft than hard in quality. Bromide of potassium is an excellent retarder for this developer, but a greater proportion should be used than for hydroquinone. It is thus apparent that audriol may be used in short exposures, and thus be of value for exposures made in the studio by dim light, for rapid instantaneous work, cinematograph films and X ray exposures.

The Scientific American in South America.

We notice the following in our esteemed contemporary The Wheel: "A traveler for an export house returns from South America and says that in Brazil and several other South American countries the trade papers he saw most frequently were The Wheel and the SCIENTIFIC AMERICAN."

THE manufacture of "khaki" cloth has been greatly increased by the war in South Africa, and over 15,000 people are now engaged in making cloth for the soldiers. The word "khaki" is of Hindoo origin, and means dust or clay colored. It is made entirely of cotton and is exceedingly durable. It was probably first used by the English regiments in India, and was also worn by them in the Egyptian campaigns. The color is not attractive, but it is very satisfactory for service in warm countries.

THE SAN JACINTO EARTHQUAKE.

BY PROF. CHAS. FRED. HOLDER.

The San Jacinto earthquake, on Christmas morning, was the severest earthquake since that of Fort Tejon in 1857. There seems to be a remarkable diversity of opinion as to the number of shocks, the duration and the direction of the wave; the fact that there is no seismograph in or about Riverside County explaining the lack of definite data. I was in Pasadena, and was awakened at four twenty-five. I endeavored to catch the direction of the waves during probably four or five seconds, then being urged to leave the room I rose and walked out into the hall and stood a few seconds. I could not distinguish a wave motion. The dishes were hopping up and down in the butler's pantry below, while every picture in the house was swinging in an altogether uncanny manner. Thinking that it might be a dangerous earthquake I threw open the window, expecting to hear the crash of stone or brick buildings, but by that time the shock had ceased. I judged that it lasted nearly half a minute, though this is supposition.

Experiences differ materially. A friend not far away stated that he was almost thrown down and noticed three distinct waves, while the sensation conveyed to me was that the house had been seized and shaken violently. Little or no damage was done in Los Angeles County, or in San Diego, where a small tidal wave was noticed. The maximum force of the earthquake centered at San Jacinto, about eighty miles from Los Angeles, a thriving little town, with a population of twenty-five hundred, in a ranching district, and a part of Riverside County. It stands at the foot of a lofty mountain, called Tarquitz by the natives, the Saboba Indians, who have a legend that it always gives warning of an earthquake by a roaring or bellowing; and these subterranean sounds were heard a week or so previous to the earthquake. In the immediate vicinity are sulphur and hot springs.

Earthquakes, at least small ones, are not uncommon at San Jacinto, and at the present time—December 28—the stricken towns have experienced several slight shocks every day since the 25th, which has aided in keeping up the suspense and demoralization into which the people were thrown. The shock came at 4:29 A. M., and according to many at both Hemet and San Jacinto, lasted a minute, though probably a half minute was nearer the actual duration. There was no warning; the shock came and continued, and almost every brick and stone building in the towns mentioned was either thrown down or partially ruined, and in half a minute or less, the entire population was in the street; women panic-stricken and men frightened and demoralized with the roar of falling bricks and the crash of timber. There were no lights, and the people groped about in darkness, fearing to go back to their damaged homes, and many passed the remaining time until daylight out of doors, when the full work of the earthquake was seen. While not thrown down, almost every building of brick in the business portion of the town of San Jacinto was wrecked. Fronts, backs or corners fell in, and a general view up Main Street, San Jacinto, conveys the impression of a wreck more or less complete, bricks and other material in some instances being thrown far into the middle of the street.

A singular feature of the damage is seen in the San Jacinto Bank. The top of this building was jerked away, and the right hand upper corner wall thrown into the street.

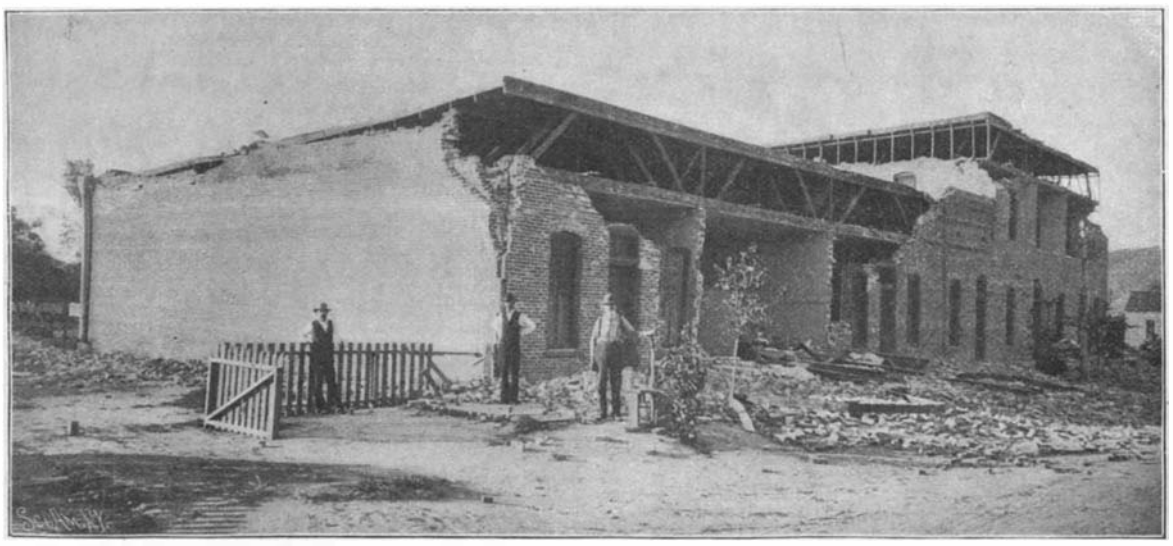
In the opposite end of the same block the injury is duplicated, the corners apparently receiving the force of the wave. In the County Hospital, which was recently erected at an expense of $10,000, the front of one large room was thrown violently down into the street, and the whole building wrecked.

At Hemet some walls, as in the Johnson block, fell outward; others, as the second story of the Hemet mill, fell in. There was evidence of a rotary motion at various places, which several persons testified to. In Hemet but two chimneys stand, and the business portion of the town is badly damaged. The hotel was injured to the extent of twenty-five thousand dollars, and is, in all probability, a total wreck. In the town of Corona the shock was severe and many of the brick buildings were damaged. At the Highland State Asylum for the insane the gables were cracked and chimneys fell.

The most remarkable feature of this earthquake was that so few lives were lost. From the accompanying photographs, which were taken by Frederick H. Rogers, of San Jacinto, it will be seen that the buildings on each side of Main Street were virtually ruined; yet not a person was killed and but few injured. The only fatalities were at the Indian Reservation of Saboba. Here the Indians had collected and were celebrating the approach of Christmas by a dance, and a room with adobe walls, in which were eight old squaws, fell in, killng them all. Some of the escapes were marvelous.

The clerk of the Hotel Hemet was covered in bed by the chimney, which came crashing through the roof, filling half the room. Another chimney fell and covered the bed in which a woman and child lay; yet they were uninjured. Another woman, who had been awakened and was wishing her husband a merry Christmas, started out of the bed in time to see the front of the building fall outward, leaving the bed on the edge. In Hemet singular injuries are seen. In the McKie block the top of the front wall was jerked out. The bank in the Hemet building lost its fire wall on one side; the other being badly cracked. In this block was the Prugh crockery store, and the crockery was piled up in the center as though a whirlwind had struck it. An inhabitant of Hemet informed me that the chimney of her house was lifted and turned partly around, as though by a whirling motion, but not thrown down. The Johnson block was practically ruined.

In the streets of Hemet small fissures or cracks were visible, being larger in the direction of San Jacinto. The pipes of the Hemet Water Company are cracked or broken in numbers of places, but it is believed that the Hemet dam is uninjured. While great loss has fallen on this locality, the people are by no means discouraged, and have already commenced to rebuild their homes. Doubtless, if the brick buildings had been riveted with steel, as all stone buildings should be in California, the wreck would not have occurred. The towns visited are situated in a rich ranching region, and in a few months all traces of the earthquake will have been removed, and perhaps almost forgotten, as it is a somewhat singular fact that while an earthquake is dreaded, people who suffer do not desert the place, especially in Italy, where villages flourish on the site of the ancient lava flows of Vesuvius. The effect of the earthquake upon the surrounding country is not apparent, but there were undoubtedly some changes. Miners who have come in since report that a bowlder weighing many tons was seen rolling down the mountain side, narrowly escaping a mill by a few feet. The hot springs near San Jacinto took on for the time new energy, while the fumes of sulphur have increased so that it has been almost impossible to approach them.



F. H. Rogers, photo., San Jacinto, Cal.

RUINS OF THE COUNTY HOSPITAL.

F. H. Rogers, photo., San Jacinto, Cal.

EARTHQUAKE IN CALIFORNIA—WRECK OF A HARDWARE STORE.

Agriculture in the Yukon.

Vice-Consul Morrison, of Dawson City, sends, under date of October 16, 1899, a report on the results of agricultural experiments, written by a resident of that city, which reads, in part, as follows:

"Grain has done exceptionally well, being well filled, and I see no reason why it should not be extensively and successfully grown here. As far as my observations go, the climate here is as suitable for raising winter wheat as in any place in the Northwestern or the Northern States of America. From my experience of the last two years, I see no reason why this country should not be able to produce its own vegetables and grains.

"As for flowers, the success I have had proves that all hardy annuals will do well. The coming year I intend planting several hundred hybrid roses; also summer flowering bulbs, a large variety of other hardy and half-hardy annuals, and some of the hardy perennials. Small fruit, such as strawberries, currants, blackberries, and raspberries, should do well. Currants, raspberries, cranberries, strawberries, and blueberries grow wild here."

The Current Supplement.

The current SUPPLEMENT, No. 1254, has many articles of unusual interest. "The History and Present Development of Wireless Telegraphy" is by Greenleaf W. Pickard. "The Home-made Windmills of Nebraska," by Erwin Hinckley Barbour, is illustrated by thirteen engravings and is a most valuable treatise on the subject. "The Geology of the Klondike Region" is by J. B. Tyrrell. "The Bad Lands of North Dakota" is by Prof. Ralph S. Tarr. "A Comparative Study of the Physical Structure of Labrador Eskimos and New England Indians" is an illustrated lecture by F. Russell, Ph.D., of Harvard University, and is accompanied by elaborate engravings. "Cycle Construction and Design," by Archibald Sharp, is illustrated by 12 cuts.

"Reminiscences of Bunsen and the Heidelberg Laboratory" is by Dr. H. C. Bolton.

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RECENTLY PATENTED INVENTIONS.

Bicycle-Appliances.

BICYCLE.—JOHN A. KELLY, Brooklyn, New York city. The driving mechanism of this bicycle is so constructed that while the hands are used as drivers they may at the same moment be brought into action separately or together to steer positively. The movement of the hands may be stopped or the driving action resumed at will without at any time losing control of the steering mechanism. In directing the bicycle to the right or to the left, there is no lost motion.

LOCK. — OTTO VON NORDHAUSEN, U. S. S. "Galveston," Galveston, Tex. The purpose of this invention is to provide a device which may be attached to a bicycle and by which the pedal-crank may be locked against rotation, so that the bicycle-wheel can not turn. The lock comprises a case having two pins projecting toward each other from opposite sides and terminating short of the center of the case. Keepers are pivoted on the pins, and a bolt lies between the keepers and the ends of the pins, and is adapted to be engaged by a key to throw it. The bolt has a locking recess. A guide projects from the top of the case between the keepers, upon which the bolt slides. A locking-pin is mounted to slide in the casing, is adapted to enter the recess, is spring-held and extends outside the case, so that it may be hand-operated.

Electrical Apparatus.

STORAGE BATTERY.—CHARLES and HARRY LINDENBERGER, and WILLIAM B. TEAL, 354 Century Building, St. Louis, Mo. The casing of the battery is made of aluminium, and comprises two conducting-sections removable one from the other and insulated one from the other, A lining of insulating material extends around side walls on one of the sections. Asbestos pads placed against the lining serve as reservoirs to hold and distribute the electrolyte. Of the two battery elements employed, one is in electrical connection with one section of the casing and the other in electrical connection with the other section of the casing. An absorbent pad is placed between the two elements. There is no possibility of buckling, change of shape, or dropping out of active material.

Mechanical Devices.

WRENCH.—HARRY W. LIBBY and CHARLES R. SWETT. Canton, Me. The wrench has a shank terminating at one end in a fixed jaw and teeth adjacent to the jaw. A handle is attached to the other end of the shank, and a U-shaped slide is mounted on the shank. The head of a pin is fastened in the front portion of the slide to close and hold it movably on the shank. A tubular casing carried by the handle extends along the shank. A spring is mounted in the casing and bears between the handle and the pin to move the slide toward the fixed jaw. A roller jaw is mounted in the slide and meshes with the teeth of the shank. The roller-jaw acts with the fixed jaw to hold round, jammed, and flattened objects.

WIND-MOTOR.—JUDSON S. LANDON, Schenectady, N. Y. The purpose of this invention is to provide a wind-motor which will be very sensitive to light currents of air and which will uniformly and regularly transmit the power directly to a pump or other apparatus placed at the base of the tower. To this end the invention embodies a pole mounted to move in a number of directions and carrying a blade or object offering resistance to the wind, so that as the pole is swung from point to point with the varying gusts of wind, the movement of the pole may be transmitted through gearing to the apparatus to be driven.

CANNING-MACHINE.—OREN RUBARTS, Newport, Ore. The purpose of the invention is to provide a simple machine by means of which salmon meat can be quickly forced into the cans in an unbroken condition and avoid the handling of the meat by many persons. The canning-machine comprises a trough provided with a forming-tube. A can-clamping device at the outlet of the tube is mounted to swing relatively to a base. A cutting-blade is movable between the clamping device and the outlet end of the tube. A plunger consisting of teeth movable longitudinally of the trough is carried by a sliding cover on the trough, through which cover the teeth are movable vertically.

FIREARM. — JACOB G. AESCHBACHER, Rosario de Santa Fé, Argentina. Attachments have been devised by this inventor which can be quickly applied to any revolver or other firearm, and which will enable a marksman to use a cartridge of small caliber in a revolver or arm constructed to carry a cartridge of larger caliber, thereby not only economizing in ammunition, but also reducing the noise of the explosion and enabling a marksman to become familiar with his weapon. The attachments will not necessitate the alteration of the weapons to which they are applied nor impair the accuracy of fire of a piece.

MACHINE FOR CONSTRUCTING IRRIGATING OR OTHER PIPES. JOSEPH H. MARTIN and DAVID ORMAND, Riverside, Cal. In this machine a section is arranged to supply material, and within the section a plunger operates. A mold has a sliding movement upon the supply-section and is provided with a revolubly mounted core. The plunger acts at one stroke to move the supply-section and at the next stroke to carry the mold in the same direction as the supply section. By reason of the friction of the mortar against the sides of the mold, the mortar or cement is prevented from being pushed through, thereby breaking the pipe already made. This friction is great enough to force the other supply section ahead.

DUMPING APPARATUS.—BRUCE SIMS, Paris, Ill. This invention is an improvement in apparatus adapted to dump loaded cars or wagons automatically irrespective of the size of their wheels. A slotted platform is provided having wheel stops of rails pivoted in the slots and having lateral projections at the front end. A transverse trip bar, having a vertical lever, is supported in hangers adapted to permit lateral oscillation of the bar. The front axles of cars or wagons having different-sized wheels will be carried down into about the same proximity to the platform, and very nearly the same inclination will be given to the car or wagon bodies in all cases.

BOTTLE-WASHER.—HENRY E. DECKER, Manhattan, New York city. The bottle-washing machine comprises a motor upon which a bracket is supported having a hollow head in which a perforated water-receiver is contained, communicating with the motor-shaft. A valved supply-pipe leads into the hollow head. A tubular shaft has connection with the water-receiver and carries wipers and a longitudinally-movable mouthpiece. A spring is attached to the motor-casing and engages the mouthpiece. The movements of the mouthpiece control the supply of water to the water-receiver. The wipers are spread outward by centrifugal action to engage against and wash the inner surface of the bottle. As the bottle is drawn outwardly the spring will move the mouthpiece with the bottle and close the valved pipe.

Railway-Contrivances.

CAR-BRAKE.—JAMES RITCHIE, Flatbush, Brooklyn, New York city. This invention provides a car-brake so constructed that any wear of the bearing between the brake-shoe and the hanger or between the hanger and the hanger-head will be automatically taken up, thus insuring tight or close bearings, so that all noise or rattling incident to the setting of ordinary brakes is done away with.

Miscellaneous Inventions.

CLAMPING DEVICE FOR BROOM-HEADS.—SAMUEL P. HERRON and CHARLES F. GRAY, Bertha, Ky. This device is a simple attachment for securely binding together the straw or other material employed in the construction of the brush-sections of brooms, the device being located at the head of these sections. The clamping device is so constructed that even an unskilled person can group and correctly set up the straw and secure it firmly in the desired position.

VEHICLE.—FREDERICK MENZER, Flint, Mich. This invention provides a vehicle-body of such construction that double and single accessory seats may be located in a back extension of the body and be protected by a boot when not needed. The boot is constructed in sections arranged to lie horizontally, one adjoining the other, or occupy a vertical position and constitute backs for the accessory seats. Drop-doors in the sides of the extension enable access to be conveniently gained to the extension of the body when the accessory seats are in use.

ACETYLENE-GAS MACHINE. — JAY S. SEELY, Syracuse, and EDWIN M. RODENBERGER, Walworth, N. Y. Upon the gasometer-bell a plunger is secured, and upon the gasometer-tank a small water-tank is carried adapted to receive the plunger. As the plunger descends into the small tank, water is forced up into a pipe leading to the carbid. As the gas is generated and passes into the bell, the plunger will be carried up out of the tank, thus causing the water to subside below the level of the pipe and automatically stop the generation of gas.

CALCINING-FURNACE. — ARTHUR H. WETHEY, Butte, Mont. This calcining-furnace is an improvement on a double-hearth furnace devised by the same inventor. In the present invention a series of superposed single hearths are supported by two opposite rows of vertical posts, between which and the longitudinal sides of the hearths are arranged on suitable supports connected with the posts the rails whereupon the rake-wheels travel. The brick-work of the hearths and arches is carried by longitudinal I-beams extending along both sides of each hearth and supported by devices connected with the vertical posts. This construction and arrangement of parts have been found to possess important merits.

ACETYLENE-GAS GENERATOR. — LOREN B. WALTERS, WILL H. DAVIS, and AUGUSTUS L. HAWKINS, Georgetown, Tex. The generator comprises a gasometer within which a generator is located consisting of a water-reservoir having a gas-connection with a gasometer-bell. A water-measure is provided having a valved connection with the water-reservoir, controlled by the bell. A water-receptacle has a siphon connection with the water-measure. A carbid-retort has a gas-connection with the water-reservoir and a water-connection with the water-receptacle. The gas before being burnt is washed, dried, and filtered so as to insure the production of an exceedingly white light.

CURTAIN-PIN.—ST. CLARE F. STENNER, Portland, Ore. The curtain-pin comprises a hook for engagement with a curtain-pole ring, and a safety-pin integral with the hook and having a slidable point-receiver arranged to engage the free end of the hook to close the latter and form a keeper for the point of the safety-pin. The pin cannot be accidentally detached from the curtain and is designed for hanging heavy curtains and portières of all kinds.

MEANS FOR IRRIGATION AND DRAINAGE.—EUGENE A. BAGBY, Winchester, Ky. These improved means for irrigation and drainage are readily applied to plants growing in pots on greenhouse-benches or to level or sloping ground and arranged to receive a predetermined quantity of moisture, as needed to facilitate their growth. Water from a heavy rainfall is automatically stored and distributed for use during a subsequent dry season. The invention is based upon the employment of capillary attraction.

GRAIN-DRIER.—HENRY W. CUTLER, Wilbraham, Mass. The grain drier is provided with a stationary steam-plug comprising two pipes one within the other to form a steam-passage and a water-passage. A head receives the outer ends of the pipes to form a steam-inlet and a water-discharge, one separate from the other. The inner ends of the passages have connection with the steam-inlet for the drying-cylinder and the discharge of the water of condensation. The steam circulates in every pipe of the drier; and binding of the steam-plug in the journal of the drying cylinder is prevented.

ORE-CONCENTRATOR.—HENRY EARLE, Canyon, Colo. The chief difficulty encountered in the concentration of finely-divided ores is that the particles of valuable material are so nearly of the same specific gravity as the valueless material that the valuable portions float in the water and are carried away and lost. To prevent this loss, the inventor constructs his concentrator with an inclined air-tight chute, V-shaped in cross-section and divided into compartments having communication at the bottom. The lighter material is carried off from the top portions of the compartments one independently of the other. Pipes receive the heavier particles or ores at the bottom of the compartments.

SAIL.—JOHN DUTHIE, Portland, Ore. The purpose of this invention is to provide a sail for both square and fore-and-aft rigged vessels, which sail for a given size will provide a greater wind-area and consequently drive a boat faster than the type of sail now in use. This end is attained by forming the sail with a number of concavities or recesses, produced by loose sections of canvas and arranged to reverse as the vessel changes from one tack to the other. These concavities or recesses serve to gather and retain the wind and thus increase the efficiency of the sail.

MANUFACTURE OF SOOT-KILLERS.—OLIVER R. MOFFET, Joplin, Mo. This soot-killer for furnaces and stoves consists of zinc, charcoal, and oil. In burning the composition, carbon dioxid gas is formed, which consumes the soot. The products of combustion pass through the smoke and gases of the furnace out of the chimney in the usual manner.

EGG-CARRIER.—WILLIAM H. H. ROGERS, Brooklyn, New York city. It is the object of the invention to provide a new and improved egg-carrier which is arranged with single compartments for the eggs and which can be folded when not in use. The invention consists principally of a box-body formed with a top having integral flaps cut out of the top and adapted to swing down into the box-body to form compartments with openings in the top for the insertion of the eggs.

LANTERN.—ROYAL JACKMAN, Anthony, New Mexico. The novel feature of this invention is found in a lantern-top so constructed that light-rays may be emitted through them at will, so as to illuminate objects located overhead. To this end the lantern-top is provided with an opening of due size which is normally closed by a rotary slide having a portion impervious to light and on the opposite sides an opening for the passage of light.

GASOLENE-LAMP BURNER.—ALBERT S. NEWBY, Chanute, Kans. The novel features of the invention are found in a valve comprising a body having a passage containing the valve-stem and carrying the gas-supply. The body has a coned seat for the valve-stem inward from its end. A passage extends from the seat to its end; and a thin diaphragm closes its outer end. A valve-stem having a coned shoulder engages the coned seat; and a squared end simultaneously engages the diaphragm about a hole therein; and a point or pin enters the hole so as to clean the aperture of all sediment and leave the latter clear for the escape, of the gas when the valve is opened.

INCANDESCENT-MANTLE SUPPORT.—ALBERT S. NEWBY, Chanute, Kans. The main object of this invention is the provision of a mantle which is already hung upon its support so as to avoid the difficulty and the danger to the mantle of endeavoring to hang it to a separate support. The mantle and the support are furnished together, it being necessary only to insert the lower end of the mantle support within a socket to secure it in place upon the burner.

INCANDESCENT GAS-BURNER. — ALBERT S. NEWBY, Chanute, Kans. The inventor has devised a cap which can be applied to ordinary burners so that they may use a larger mantle than that heretofore employed, thus increasing the illuminating power of the lamp. To secure this result, the cap is slipped over the upper end of the tube which supplies the mixture of air and gas, the cap being enlarged at its upper end so as to spread the flame more and accommodate a large-sized mantle.

Designs.

WALL-PAPER.—HARRY WEARNE, Rixheim, Germany. The leading features of the design are a medallion upon which a cupid is pictured, a floral wreath surrounding the medallion, a basket of flowers, and a medallion between the basket and the wreath, the latter medallion being decorated with a quiver, bow, and flambeau.

CHILD'S PLATE.—JAMES H. STRUGNELL, Toronto, Canada. The bottom of the plate has a flange and a downwardly and outwardly curved rim. The plate, by reason of this construction, cannot be overturned.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

NEW BOOKS ETC

THE NAVAL WORDBOOK. Ein systematisches Woerterbuch marine-technischer Ausdruecke in englisher und deutscher Sprache. Von N. W. Thomas, M.A. Kiel and Leipsic: Lipsius & Tischer. 1899. 12mo. Pp. 146. Price $1.

The need of a good dictionary of German-English nautical terms has long been felt; and the little book which Mr. Thomas has compiled is therefore to be regarded with more than usual favor. An alphabetical arrangement of terms is perhaps to be preferred to the classification of parts adopted in the dictionary; but the usefulness of the book is thereby not impaired.

HANDBUCH DER INGENIEURWISSENSCHAFTEN. Zweiter Band: Der Brueckenbau. Herausgegeben von Th. Landsberg. Dritte vermehrte Auflage. Leipsic: Wilhelm Engelmann. 1899. Small quarto. 306 illustrations and 30 plates. Pp. 578. Price, paper $8.

The admirable first and second editions of the "Handbuch der Ingenieurwissenschaften," so ably supervised by Drs. Schaffer and None, of the Technical High-School of Darmstadt, are so well known to most engineers, that an extensive review of this third edition is perhaps unnecessary. Prof. Landsberg in the new edition has shown himself fully equal to the task of directing a work which in its scope and thoroughness can be truly termed monumental. The third edition, revised and enlarged, will undoubtedly take its place among the authoritative books on engineering.

LEXIKON DER METALL-TECHNIK. Redigirt von Dr. Josef Bersch. Parts 11–15. Vienna: A. Hartleben. 1899. Each part 70 cents.

DIE MODERNE CHEMIE. Eine Schilderungen der chemischen Grossindustrie. Von Dr. Wilhelm Bersch. Parts 11–15. Vienna: A. Hartleben. 1899. Each part 70 cents.

Both of these works have at various times been noticed in this column. The last installment of each is numbered 15. The "Lexikon der Metall-Technik" is nearing completion; the "Moderne Chemie" has still to run through fifteen additional numbers.

EVOLUTION DU CARBONE ET DE L'AZOTE DANS LE MONDE VIVANT. Par P. Mazé. Paris: Georges Carré et C. Naud. 1899. 12mo. Pp. 110. Cloth $1.

This little volume on carbon and nitrogen has been written with a care which would do credit to a work more pretentious. The descriptions of chemical reactions, of analyses, and experiments are characterized by a clearness which is indeed refreshing. We have before had occasion to notice the scientific publications of Messrs. Carré et Naud. It must be confessed that the standard of the earlier scientific works has been well maintained.

THE ROYAL NAVY LIST DIARY AND NAVAL HAND BOOK FOR 1900. London: Witherby & Company, 326 High Holborn. Pp. 609. Price $1.25.

This, the third year's issue of this admirable hand book, is characterized by the general excellence which marked its predecessors. The diary portion is arranged to give a whole page to a day and is furnished with separate index, memoranda, etc., schedules for recording all ports visited, and complete schedules for recording drills, etc., and making up official returns. In the letter-press are a calendar of notable naval events; an obituary for the year and a list of the Benevolent Funds and Institutions of the Royal Navy. Among the original articles is one on the Naval Progress of the year, which is the best of the kind we have read for some time past.

SOCIAL LIFE OF SCOTLAND IN THE EIGHTEENTH CENTURY. By Henry Grey Graham. London: Adam & Charles Black. New York: The Macmillan Company. 1899. 8vo. 2 vols. Pp. 520. Price $7.50.

The eighteenth century is considered by many to be the most interesting in the Christian era, largely on account of precisely the same social events as are chronicled in these scholarly volumes. Probably no period was so quietly eventful in shaping the fortunes and character of Scotland as this century. The striking incidents of the period and the routine of town and country life all have their place in the readable and handsomely printed pages. Those who are fond of information regarding either men of the period or manners cannot fail to draw valuable knowledge from these admirable volumes, for no phase of the subject seems to have escaped the author.

A BRIEF HISTORY OF THE CITY OF NEW YORK. By Charles B. Todd. New York: American Book Company. 1899. 16mo, cloth. Pp. 299. Price 75 cents.

It is a most admirable idea to inculcate in the young a love for the history of some city. The history of a country is something general, while that of a city is concrete. No cities save perhaps Rome, London, and Paris repay study as well as New York with its quaint memories of Peter Minuit, Wouter Van Twiller, Wilhelm Kieft, Peter Stuyvesant and others. This little book is a most admirable one, and its field of usefulness should not be allowed to become restricted to the schoolroom; it can be read by any one with both pleasure and profit.

BEASTS. THUMB NAIL STUDIES IN PETS. By Wardlaw Kennedy. London and New York: The Macmillan Company. 1899. Square 12mo. Pp. 152. Price $1.50.

This is one of the most delightful books upon animals that we have seen for a long time. It is a most curious and interesting book, and the illustrations are most desirable. It gives attractive pictures and anecdotes of "Pharaoh," which was brought from the Nile in the egg and hatched over a spirit lamp. The comical antics of this animal are second only in interest to the remarkable antics of the pet armadillo and an Indian mongoose. It is a book which we could recommend for the use and instruction of the young who are interested in natural history.

AN OUTLINE OF VENTILATION AND WARMING. By William J. Baldwin. New York. 1899. 18mo. Pp. 70. Price $1.

The author is a well known expert on heating, and the information given in the little book is in concise form.

ETUDES SUR LES FOURMIS, LES GUÊPES, ET LES ABEILLES. Note 18. Aiguillon de la Myrmica rubra. Appareil de fermeture de la glande á venin. Par Charles Janet. Paris: Georges Carré et C. Naud. 1899.

EXTRAITS DES MÉMOIRES DE LA SOCIÉTÉ ZOÖLOGIQUE DE FRANCE. Sur les Nerfs céphaliques, les Corpora Allata, et le Tentorium de la Fourmi. Par Charles Janet. Three plates. Paris. 1899.

EXTRAIT DES MÉMOIRES DE LA SOCIÉTÉ ZOÖLOGIQUE DE FRANCE. Etudes sur les Fourmis, les Guêpes, et les Abeilles. Anatomie du Corselet de la Myrmica Rubra Reine. Note 18. Par Charles Janet. One plate. Paris: Georges Carré et C. Naud. 1899.

Business and Personal.

The charge for insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in the following week's issue.

Marine Iron Works. Chicago. Catalogue free.

For mining engines. J. S. Mundy, Newark, N. J

"U. S." Metal Polish. Indianapolis. Samples free.

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The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Refrigerating Machine Company. Foot of East 138th Street, New York.

The best book for electricians and beginners in electricity is "Experimental Science," by Geo. M. Hopkins. By mail, $4. Munn & Co., publishers, 361 Broadway, N. Y.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated: correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(7787) R. E. W. asks: 1. Could a 110 volt direct current be used in the Thompson-Tesla coil described in SUPPLEMENT, No. 1087, by putting on an automatic circuit breaker operated by the magnet of the coil or would it be necessary to change the direct current into an alternating current? A. You can use a 110 volt direct current to run an induction coil, but it should be controlled by a resistance box, so that only perhaps 30 to 60 volts may be broken by the circuit breaker. 2. About how many amperes would it take to run the above coil proper, using a 110 volt direct circuit? A. The amperes will vary with the adjustment of the rheostat. Begin with the resistance all in and turn out resistance till the tube is properly energized. It may require four to ten amperes. An X-ray tube requires more current as the vacuum rises in it. 3. Why is the 2-inch iron pipe slotted? A. To prevent the eddy currents which would circulate around a tube heating it unduly. 4. In the secondary of the high tension transformer, about how many pounds of wire will be required for each of the ten sections? A. About four pounds per coil are required. 5. Could the air gap in the high frequency coils be filled with any substance such as paraffine or sealing wax? A. Yes. Paraffine oil is the best substance to be used. 6. Would you mention one or two SUPPLEMENTS in which I could find articles on an induction coil to be operated by a 110 volt direct current and giving a 3 or 4 inch spark? A. We have no plans for such a coil. Bonney's "Induction Coils," price $1 by mail, will give you the information you need.

(7788) C. H. writes: In many places power is used to run mills in the daytime. Can power be put into the storage battery and used to help out at night to light the streets and dwellings? Can it be done from a direct current 110 volts, and what loss would this be in storing electric power, also the expense of a battery that could be used 5 hours, and what could be got from it on the incandescent lamp? A. The SCIENTIFIC AMERICAN has had a great many articles on this matter. It is easily possible to charge a storage battery by day when a mill is running and use the electricity from it in the night when the mill is shut down. Each installation of this sort differs from others, and we cannot give any instructions so that a man not an expert in electrical work could put the machinery and lamps in place. An engineer should be employed to oversee the work and to determine what shall be done. He will give figures of cost which will differ in different places. The cost will be more than for oil or gas.

(7789) H. P. J. asks: Could you give a formula for something that will really prevent mildew in sails? A. Dissolve 1 pound zinc sulphate in 40 gallons water, and then add 1 pound sal soda. When dissolved, 2 ounces tartaric acid are added. This holds the partially separated zinc carbonate without neutralizing the excess of alkali used. The canvas, etc., should be soaked in this solution for 24 hours, and then dried without wringing.

(7790) C. A. R. asks: Can an ⅛ horse power electric fan be operated by electric bell batteries, and how many batteries will it require? A. The number of cells required to run an eighth horse power electric fan depends upon the voltage for which the motor was wound. This is marked on the motor somewhere. To find the number of cells, divide the voltage by the voltage of one cell. If by electric bell batteries you mean dry cells, it will not be possible to run a fan for any length of time by them.

(7791) R. F. P. writes: In answer to query number 7758, I would say that he may find a description with illustrations and working drawings for the building of a telegraph sounder, as well as several other electrical instruments, in Trevert's "Experimental Electricity," price 85 cents by mail.

(7792) W. H. T. writes: 1. I am about to construct a sectorless Wimshurst machine, and would like to know a few facts about the revolving glass disks, and ask a few questions. Two disks, which are 18 inches in diameter and composed of double thicknesses of window glass, are pierced centrally with a ¼ of an inch hole; would a fixed iron spindle, ¼ of an inch in diameter, be sufficient to support the weight of the glass disks? I intend to have the spindle fixed and at least 12 inches long, the glass disks attached to wooden bosses, which are also pierced centrally with a hole ¼ of an inch in diameter, the pulleys for the rotation of the plates being also attached to bosses. Am I right? A. We should advise a much larger spindle than one-¼ inch in thickness upon which to run the plates of a Wimshurst machine. So thin a rod will vibrate and bend, and the parts which turn upon it will wear much faster than they will upon a larger bearing. You had better make the spindle as thick as ¾ inch. 2. How large in diameter should the bosses be, so as to have enough surface for the cement to act, so as to occasion no danger of the wooden boss and the glass disk separating when revolving at an ordinary speed? A. The bosses may well be 3 inches in diameter. 3. Would it be best to give the glass disks and also the glass supports a coat of thin shellac? Would it increase the efficiency? A. A coat or more of shellac will prevent the wood from absorbing moisture and so benefit it. 4. Would a machine of this size have sufficient length of spark and output to produce the X-rays in a suitable tube? A. A machine with 18-inch plates will energize a small X-ray tube. 5. I have read from some papers—I can't remember the name—that a fluorescent screen for X-ray work can be made by coating a piece of cardboard with glue and then sprinkling white oxide of zinc on it. Is that true? A. No. The fluorescent screen should be made of calcium tungstate. 6. Is there any place where I can procure a vacuum tube similar to the ones used by Mr. D. McFarlane Moore in his system of vacuum tube illumination? A. Dealers in X-ray apparatus can make long vacuum tube for you. You could not probably find these tubes in market. 7. I would like to know the voltage (approximately) of a spark in air under normal atmospheric conditions, 1 inch in length; also, one of 8 inches? A.—

	Volts.
Spark between points, 1 inch	20,000
Spark between points, 8 inches	87,000
Spark between points, ¼ inch spheres, 1 inch	22,000
Spark between points, ¼ inch spheres, 8 inches	95,000
Spark between points, ½ inch spheres, 1 inch	31,000
Spark between points, ½ inch spheres, 8 inches	95,000
Spark between points, 1 inch spheres, 1 inch	44.000
Spark between points, 1 inch spheres, 8 inches	99.000
Spark between points, 2 inch spheres, 1 inch	51,000

These numbers are given from actual measurements by Steinmitz, with an alternator.

(7793) A. F. J. asks: 1. Can I lift an iron weighing 500 pounds from a well 80 feet deep with a magnet on an alternating current? A. You cannot make a lifting magnet with an alternating current. A direct current must be employed. 2. Would an iron ball weighing 1,000 pounds sink to the bottom of the ocean say at a distance of 2 miles? A. A piece of iron of any size or weight will sink to the bottom of the ocean, no matter how deep it is, if it is put into the water.

(7794) J. M. C. writes: Please describe an alternating current, i. e., does an alternating current flow in one direction only, or does it flow alternately in one direction and then in the other? A. The latter. The word "alternating" implies that sort of motion.

(7795) J. R. McC. writes: I started to make the induction coil described in "Experimental Science," but cannot get any No. 36 copper wire. Could I obtain as good results by using No. 24, which is the finest I can obtain here? A. No; you may not use No. 24 wire in place of No. 36 in an induction coil, and get any results worth having. With the larger wire you will have only $\frac{1}{18}$ as many turns in the coil as with the finer, and about $\frac{1}{12}$ inch spark, which is not worth making a coil for.

(7796) A. A. A. asks: 1. How quick and how accurate, and what is the present means of determining ranges of 5 or 6 miles between vessels at sea? I might offer something to ascertain the distance (within a few feet) in less than 15 seconds at distances of from ⅛ to 10 miles. A. Various forms of range-finders are in use. They usually depend upon the solution of a triangle, where base is a base line of known length on the ship, and whose base angles are the angles observed between the line and the distant object. The accuracy will depend upon the distance of the object, being less the greater the distance. 2. Has aluminium ever been used in the place of silk for covering hydrogen gas balloons? Its weight being 2000 times that of air, could it be used as a covering in a balloon of 8-foot diameter which would require aluminium of about 1-100 of an inch thickness, and what would the strength and impermeability be compared to silk? A. The weight would be about 27 pounds, and the aluminium would be more impervious than the silk though not so strong.

(7797) J. L. asks: 1. Can you let me know a scientific way for testing the vitality of wheat? A. Plant the seed to be tested in moist soil in a flower pot to the same depth as in the field. Keep the flower pot at a temperature not exceeding 80°. Under these conditions the wheat will germinate if any vitality remains in it. 2. How deep would I have to go into the earth to reach one degree hotter in the surrounding atmosphere? A. The depth of the stratum of no change of temperature during the year varies with the latitude. At the equator it is only a foot or two below the surface, in middle latitudes it is about 60 feet, and in the Arctic regions it is probably 100 feet below the surface of the earth. At your place you will have to go down probably 70 feet to reach the place where the temperature is the same all the year through. Below this level the temperature rises as one descends at the rate of 1° for a descent of from 30 feet to 90 feet. This difference is due to the material of the earth. If it be a good conductor of heat the distance is greater than if it be a poor conductor of heat. The average distance is 53 feet to produce a rise of 1°.

(7798) A. H. Y. asks: What ought it to cost for running 500 volt ½ horse power motor from electric railway service line, motor running 104 hours a month with about ¼ horse power resistance or load? Company charges 10 cents per 1,000 watt hours with 5 per cent for cash in limited time after first of month. A. We reply to your inquiry as to what you ought to pay for current for your motor that it is not apparent that you are being overcharged. Motors often take more current than they are supposed to take. We have seen a motor using its full current as rated when it was running with no load. If you put an ammeter in circuit, you can find what current you use and can tell what your bills ought to be.

(7799) M. B. T. writes: I have a primary coil 12 inches long, 2 inches soft iron wire core, 2 layers No. 12 B. & S. wire 260 turns. Could I make about a 4 or 5-inch spark coil with ordinary magnetic interrupter, and what wire would be best for the secondary. Could I make it with No. 34 double cotton covered wire wound with proper insulating precautions, or would some finer wire be more economical? A. We should advise large dimensions for a 5-inch induction coil. You should also use a finer wire than No. 34 for the secondary. Use silk covered wire. You would better get Bonney's Induction Coils, price $1 by mail, and follow its directions with care.

(7800) S. H. L. asks: Is there any shade of color that cannot be detected by the eye that can be seen through colored glasses? Said colors to be on colored paper. A. It is possible that such a colored glass might be found, though we have not seen any reference to any such discovery. There are numerous substances which can be put on paper which will become visible when light of the proper color falls upon the paper. These are fluorescent substances. You will find these described in Wright's Light, price $2.00, and in Wright's Optical Projection, price $2.25.

TO INVENTORS.

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Check controlled apparatus, Kolb & Vogel ... 640,390
Cheese knife, M. W. Miracle ... 640,301
Chock, mooring and towing, D. E. Ford ... 640,552
Choke bore forming device, A. G. Adelman ... 640,518
Chute feet mechanism, coal, F. H. Emery ... 640,549
Clamp. See Rope clamp.
Clamp, J. L. Taylor ... 640,500
Clasp. See Garment clasp.
Cleaner. See Flue or stovepipe cleaner.
Clipping machine motor, P. Anderson ... 640,620
Cloth cutter, electric, F. Gardner ... 640,192
Clothes line reel, C. P. Wilkinson ... 640,342
Clothes wringer, W. T. Bradley ... 640,440
Coal bit, J. J. Morgan ... 640,481
Coaster and truing gage, combined, T. E. Wardwell ... 640,607
Coating oxidizable metal wire with gastight coating, F. O. Schott ... 640,419
Cock and faucet and means for diminishing waste therefrom, R. H. Staples ... 640,497
Coin freed apparatus, G. Igersheimer ... 640,202
Coin receiving, sorting, and indicating machine, E. Moriarity ... 640,683
Coin receptacle, I. B. Abrahams ... 640,435
Combination chair, Y. W. Rogers ... 640,322, 640,323
Cooking utensil, W. A. Van Deusen ... 640,605
Copy holder, O. R. Winslow ... 640,347
Corner head for plastered walls, W. F. Parker ... 640,409
Corner plate for protecting corners of plastered walls, metal, W. F. Parker ... 640,410
Coupling. See Air brake coupling. Car coupling. Hose coupling. Pipe coupling.
Crank wheel, D. Sanfork ... 640,594
Crate, shipping, R. I. Stewart ... 640,600
Cream separator, centrifugal, J. J. Berrigan ... 640,358
Cream separator, centrifugal, C. L. Kneeland ... 640,572
Crib for building piers, walls, etc., J. G. Haentges ... 640,377
Culinary roaster, T. M. Lynch ... 640,305
Cultivator, M. & A. Sattley ... 640,325
Cultivator, C. Tanner ... 640,239
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Curtain fixture, J. P. Kane ... 640,662
Curtain pole, W. H. & C. W. White ... 640,723
Curtain stretcher, W. A. Mayr ... 640,214
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Dish washer, C. H. Sterling ... 640,428
Display rack, carpet, W. Eley ... 640,187
Distance finder, R. L. Marshall ... 640,679
Distillation of hydrocarbons, apparatus for continuous fractional, H. A. Frasch ... 640,292
Door, vertically adjustable barn, F. Hering ... 640,385
Downdraught kiln, H. A. Wheeler ... 640,246
Drought equalizer, J. Rusk ... 640,592
Drill. See Grain drill. Rock drill.
Drilling apparatus, high speed, E. Watel ... 640,431
Drilling machine, C. Schmidt ... 640,708
Drinking cup, collapsible, S. M. Royer ... 640,418
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Drying kiln, F. G. Perkins ... 640,319
Dust cloth holder, W. F. Schrey ... 640,707
Dye, brown sulphur, O. Hansmann ... 640,559
Dye vat, H. Illgen ... 640,203
Electric cable terminal, W. L. Candee ... 640,363 to 640,365
Electric currents, rate indicator for, J. Harris ... 640,466
Electric discharges, apparatus for producing, M. Otto ... 640,694
Electric furnace, F. E. Hatch ... 640,283
Electric heater, F. Bain ... 640,258
Electric meter device, C. D. Haskins ... 640,196
Electric transformer, Packard & Wiswell ... 640,314
Electric wire molding or trough, H. Lee ... 640,575
Electrical apparatus, coin controlled, J. Patterson ... 640,316
Electrical distribution system, A. S. Hubbard ... 640,565
Electrical energy by alternating currents distributing, M. I. Pupin ... 640,515
Electrical transmission by resonance circuits, M. I. Pupin ... 640,516
Electrotype or stereotype block, E. L. Wilson ... 640,346
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Elevator accumulator, plunger, G. H. Reynolds ... 640,589
Elevator speed regulator, hydraulic, W. W. Doolittle ... 640,544
Engine. See Explosive engine. Gas engine. Rotary engine. Steam engine.
Engine cylinder, gas, J. W. Lambert ... 640,667, 640,668
Engine igniter, gas, C. R. Alsop ... 640,252
Engine ignition device, gas, G. W. Lewis ... 640,392, 640,395
Engines, drum attachment for traction, A. L. Adams ... 640,351
Envelop, G. H. Randall ... 640,489
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Explosive engine, J. A. Secor ... 640,711
Extension table, Curl & McAnlis ... 640,635
Fan, cradle motor, L. G. Rogers et al. ... 640,703
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Feathers into tubes, apparatus for compacting, C. T. Thompson ... 640,602, 640,719
Feed water heater, L. C. Lanphear ... 640,475
Feeder, boiler compound, L. E. Jones ... 640,306
Feeder, steam boiler, T. G. Whitney ... 640,434
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Fence post, Spoore & Raub ... 640,235
Fence weaving implement, C. A. Taylor ... 640,240
Fences, tool for attaching stays to wire, Johnson & Fry ... 640,307
Fencing machine, wire, G. Schultz ... 640,329
Fender, J. R. Reece ... 640,700
Fertilizer drier, J. F. Bussells ... 640,628
Filter, C. F. Hoyt ... 640,288
Filter, J. D. King ... 640,665
Filter, J. J. Mayer ... 640,579
Filter, C. F. Vogler ... 640,721
Filter, electric water, Teter & Heaney ... 640,335
Filter, water, A. G. Sheak ... 640,421
Firearm, magazine, B. Burton ... 640,627
Fire escape, F. H. Arnesen ... 640,437
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Flue or stove pipe cleaner, A. A. Fradenburg ... 640,190
Fluid compressor, J. B. Sample ... 640,324
Fly screen trap attachment, M. E. Moyer ... 640,685
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Garment clasp, E. D. Hinkley ... 640,658
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Gas analysis, apparatus for, G. E. Thomas ... 640,601
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Gas burners, support for globes, etc., of, J. H. Hood ... 640,659
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Governor attachment for electrical apparatus, speed, J. H. McGurty 640,688
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Guard for projecting parts, J. A. Clercy 640,535
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Harrow, J. L. Ware 640,722
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Harvester, corn, H. V. Joseph 640,389
Harvester, pea or bean, J. D. Gray 640,376
Harvester, self binder, Steward & Rand 640,599
Harvester, thresher, and bagger, combined T. P. Moran 640,682
Hasp fastener, J. Davy 640,637
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Hat fastener, L. Anderson 640,255
Hat fastener, A. B. Enns 640,542
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Header and thresher, combined, J. G. Evans 640,372
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Hinge and check, combined spring, J. W. Currier 640,178
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Hook for hooks and eyes, J. E. Pearson 640,697
Horseshoe, nailless, W. Kondakov 640,309
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Liquids, apparatus for removing saccharin or other impurities from all kinds of, J. T. Bennett 640,528
Lithographic coatings on metallic plates, producing, J. Wezel 640,245
Load controlling device, J. Ryan 640,230
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Looms, weft parter for automatic weft replenishing, H. I. Harriman 640,656
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Oiler for steam engines, automatic, L. Skinner 640,422
Oxygen, apparatus for making, F. Brown 640,531
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Rotary engine, A. H. Canning 640,269
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Tobacco pipe, G. A. Osterud 640,408
Tobacco stemming machine, Allison & Buek 640,251
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Tubing wire or other metal strips, device for, L. P. Dixon 640,640
Type bar, W. P. Quentell 640,699
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Water gage, A. L. Schram 640,328
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Water tube boiler, C. M. Hargis 640,655
Weather strip, J. L. Knight 640,472

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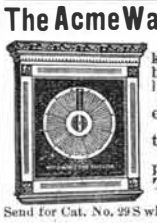

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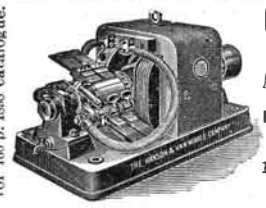

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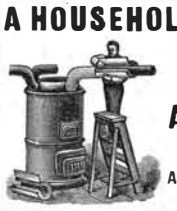

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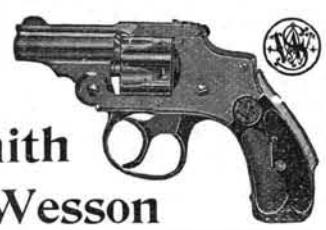

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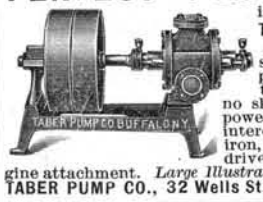

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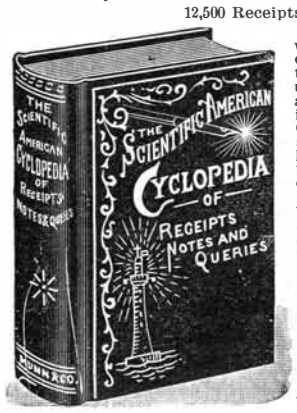

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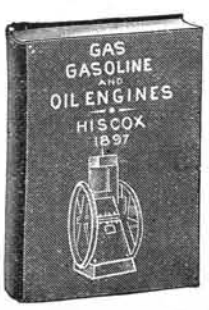

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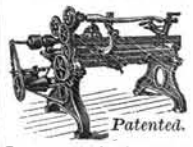

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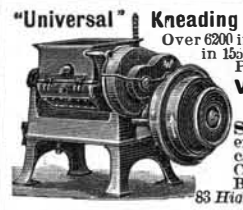

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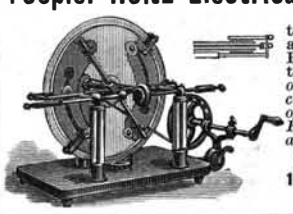

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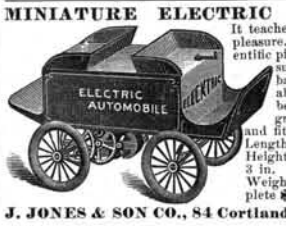

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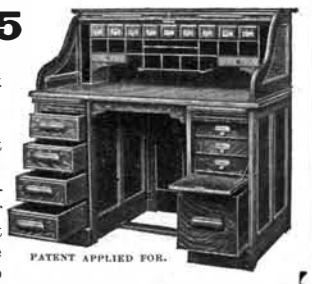

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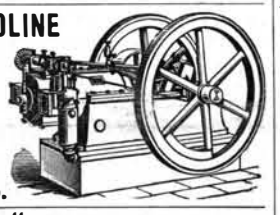

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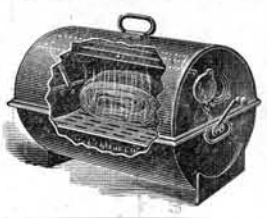

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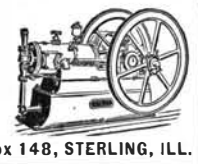

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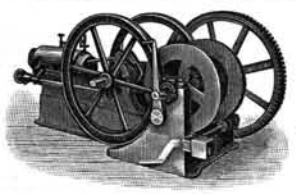

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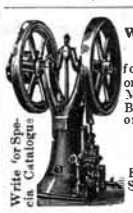

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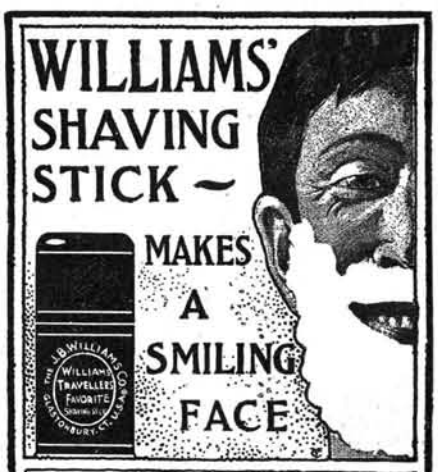

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